



AUSTRALIA'S TV calendar will always be marked with 1957 as completing its first year of telecasting.

In Britain it will also be written in history, and with even greater honour, for it saw the end of twenty-one years' operation, using substantially the same standards as are found there today.

During that period, the early story of TV was told, and every country which today enjoys a service mostly of a quality technically superior to Britain's, owes a great deal to the lessons learned from the world's TV pioneers.

When we consider the British 405 line picture standard, and a few

other technical features which go with it, we can only regret that the price paid for early leadership was anchorage to a standard doomed to obsolescence.

Nevertheless, it is a lasting tribute to the early engineers that a system worked out so long ago is still perfectly useable, despite the staggering advances in the electronic art which have taken place since then.

But the limitations of the coarse image and low frequency band must catch up in the end. Britain is faced with the problem of overhauling both when future developments are considered.

For instance, few can really believe that it would be wise to go into colour TV without adopting new standards and new frequencies.

And although the one does not necessarily demand the other, there are big advantages in bringing any prospective changes together in time.

That is why the BBC's current series of colour experiments are worth watching, for they embrace transmissions not only on higher standards, including the CCIR with and without modification, but also on the higher frequencies to which the future of TV seems to be pointing.

It isn't likely that anyone other than U.S.A. will use less than 625 lines for projected colour, and it isn't certain that, particularly if new frequency bands are opened up, compatibility will be insisted upon.

It is altogether possible that colour transmission might be developed under new standards—not merely developments of a present black and white system—with such results as to make it undeniable through its own merit.

Just as in 1936 Britain paved the way for modern monochrome, we may yet see it giving a lead in the more exciting future of colour

John Moyle

RADIO ★★ TELEVISION AND HOBBIES

A NATIONAL MAGAZINE OF RADIO, TELEVISION HOBBIES AND POPULAR SCIENCE

EDITOR

JOHN MOYLE
S.M.I.R.E. (Aust.)

TECHNICAL EDITOR

NEVILLE WILLIAMS
M.I.R.E. (Aust.)

TECHNICAL STAFF

MAURICE FINDLAY
A.S.T.C.

PHILIP WATSON
A.M.I.R.E. (Aust.)

W. YASHIN

MERVYN HUDDLESTON

Vol. 19 No. 11

SUBSCRIPTION RATES

C'wealth, NZ, N. Guinea, Fiji—
£1/4/- pa.
United Kingdom—£1/7/- pa.
B. Empire—£1/9/- pa.
Foreign—£1/11/- pa.

Phone --- B0944

OUR COVER PICTURE

An operator inserts the high temperature furnace into the body of an electron diffraction instrument which allows special study of surface changes. See story on page 15.

INDEX

World's Fastest Light Shutter	3	Probe-Type Capacitance Meter	48
New Zip Fuels	4	From the Serviceman Who Tells	55
Highly Polished Nose Cones	7	Here's Your Answer Tom	62
New Microscopic Transistor	9	Battery Shortwave Converter	64
Ever Heard of Square Bubbles?	11	Simple Course in Radio—Part 13	75
Electrons Take Over Where X-rays		Let's Buy An Argument	80
Leave Off	15	Single Groove Stereo Records	84
Manpower No Object To Ancient		Trade Reviews and Releases	91
Builders	16	Reader Built It	95
Technical Review	21	Survey of Tubeless Amplifiers	96
News & Views of the Month	29	Off The Record	102
Double-Change Amateur Tuner	32	Short Wave Notes	112
All about Audio & Hi-Fi	41	The Ham Bands	113
Colour Coding of Resistors	47	Answers To Correspondents	125



THE PALEC DYNAMOMETER

A.C. POWER ANALYSER

An Invaluable Aid in:

REFRIGERATION: Sealed unit diagnosis

TELEVISION: Servicing

PLANT: Maintenance

PRODUCTION: Testing

LOW POWER FACTOR is electrical ENEMY No. 1. Find and correct this costly electrical waste with the Palec A.C. POWER

ANALYSER, MODEL PA Australia's first DYNAMOMETER MULTIMETER for electrical service, maintenance and testing. Electricity utilised efficiently could SAVE THE COST OF AN INSTRUMENT many times over.

This A.C. Power Analyser, incorporates A TRUE DYNAMOMETER MOVEMENT of the nickel-iron cored type. There are no rectifiers or non-linear resistance included, nor is it necessary to compensate for line voltage in wattmeter readings.

ACCURACY: Effects of wave form, power factor, voltage, current and frequency variation are negligible.

EXTRAS: Leather carrying case. External Resistance Box for 3-phase testing. Current and Potential Transformers for extending ranges supplied at extra charge.

TRADE PRICE £33/15/- plus tax. TERMS.

- WATTS
- POWER FACTOR
- VOLTS
- AMPERES

RANGES

VOLTS
A.C.-D.C.
0-125
0-250
0-500

AMPERES
A.C.
0-2
0-5
0-20

WATTS
A.C.
0-10,000
9 ranges of watts
3 for each voltage range

MULTIMETERS

Two models are available:

Model M32-1,000 Ohms per Volt
Model MX32-20,000 Ohms per Volt

These multimeters are indispensable for modern ELECTRICAL, RADIO and T.V. installation and service.

RANGES:—

Volts D.C.	0/0.1-3-10-30-100-300-1000	7
Volts A.C.	0/3-10-30-100-300-1000	6
Current D.C.	0/1-3-10-30-100-300 mA-1-3-10 amp.	9
Current A.C.	0/1 mA. (for use with ext. current transformers)	1
Ohms	1-10 megohms	3
Decibels Ref. level 1 mW. in 600 ohms		3
Decibels Ref. level 6 mW. in 600 ohms		3
	Total	32

T.V. NOTE: External probe available for Model MX32 to extend range to 30,000 volts D. C.

TRADE PRICES

Model M32, £17/18/6. Model MX32, £25/17/6. All prices plus Sales Tax.

Paton Electrical Pty. Ltd.

ASHFIELD, SYDNEY • UA0381

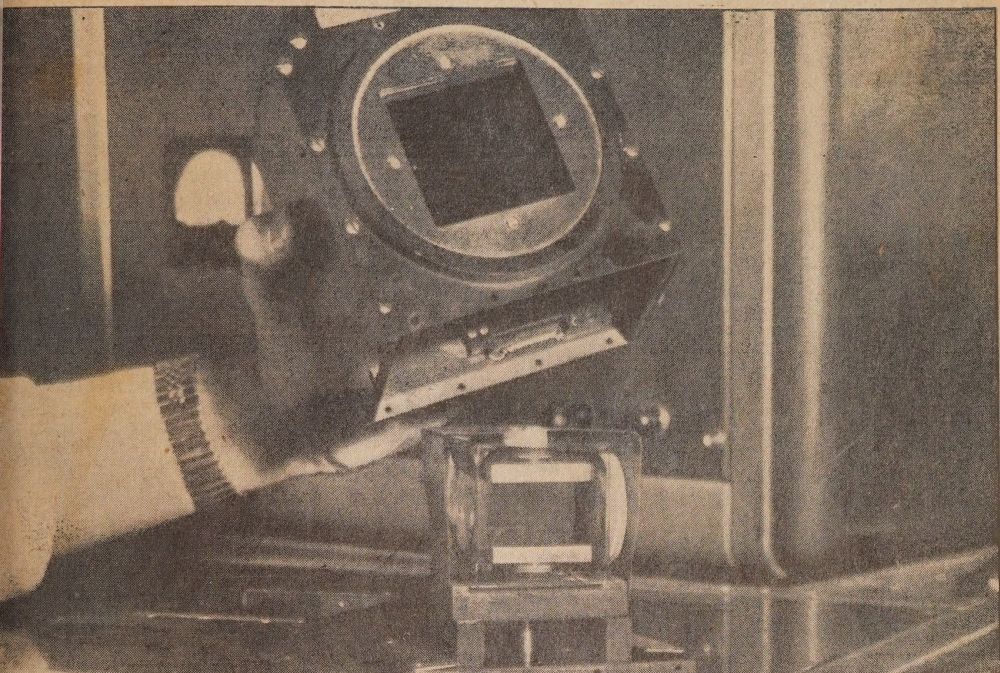
REPRESENTATIVES:

MELBOURNE: R. G. Holloway, 299 Little Lonsdale St. BRISBANE: K. H. Dore & Sons, 465 Adelaide St. ADELAIDE: Newton McLaren Ltd., 17-23 Leigh St. PERTH: Carlyle & Co. Ltd., 915-917 Hay St. TASMANIA: Gebbie Harvey Pty. Ltd., 76 Wellington St., Launceston. NEW ZEALAND: Carrel & Carrel Ltd., 41 Shortland St., Auckland.

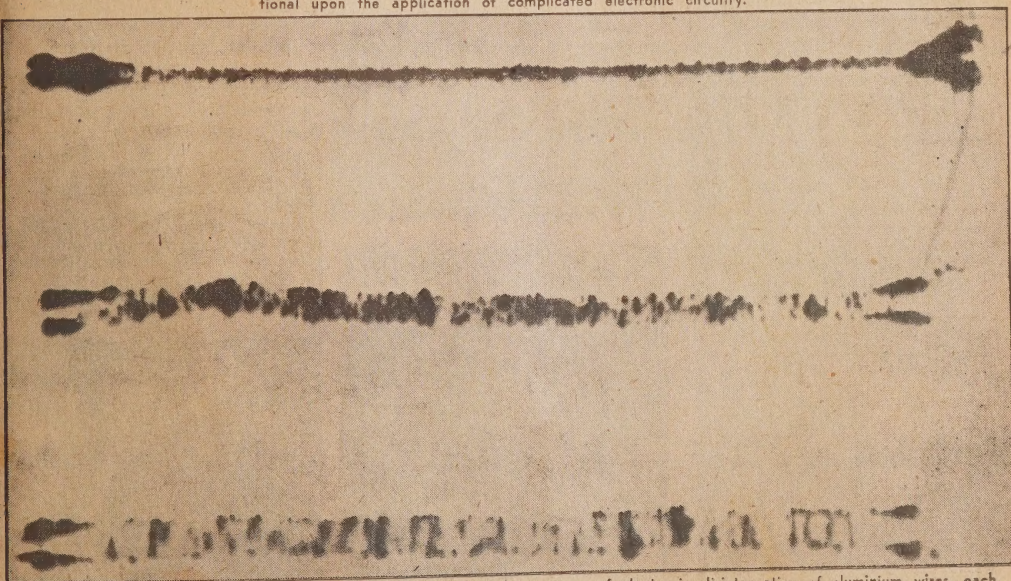


● MODEL M.32

WORLD'S FASTEST LIGHT SHUTTER



A close-up of what is claimed to be the world's fastest camera shutter which will operate at $1/5,000,000,000$ th of a second. The shutter is a Kerr cell and works in conjunction with polarized lenses. There are no moving parts. The device becomes functional upon the application of complicated electronic circuitry.



These pictures, taken with the shutter pictured above, show three stages of electronic disintegration of aluminium wires, each $1/1000$ of an inch thick. The wire (top) 20 billionths (centre) 30 billionths and (bottom) 40 billionths of a second after disintegration commenced.

New Zip Fuels Pack Fantastic Power

Burning hotter than petroleum fuels, man-made propellants will light a new fire under missiles and aircraft, building into them higher power and greater speed. At the present time they hold more promise than nuclear fuels, which have still to be tamed.

FANTASTIC high-energy propellants will soon be driving our jet planes and air-breathing missiles. Nicknamed zip fuels, they'll make defence surer and power of retaliation more to be feared.

In contrast with conventional aviation fuels from petroleum, the new ones are synthetic chemicals. These man-made propellants pack far more heat energy into a pound of fuel — and into a cubic foot of it, too. Consequently the aircraft using them will be endowed with correspondingly greater range, speed, or payload capacity.

GREEN FIRE

The most spectacular of the synthetic fuels burn with vivid green fire, and spew out a white cloud from the exhaust. They contain boron, a chemical element obtained from borax. In its pure elemental form, it is a shiny, black, hard and brittle solid.

So new that their names aren't yet in the dictionaries, these "exotic" fuels are put together from scratch by man. One of them is a liquid called pentaborane. Malodorous but potent, it yields more than half again the energy of standard

JP-4 jet fuel, eight for weight. Another with a pungent but more agreeable smell is a white crystalline solid known as decaborane. Both pentaborane and decaborane are chemical compounds of boron and hydrogen, answering to the formulas B₅H₉, B₁₀H₁₄ respectively.

Making them has proved more of a trick than these deceptively simple formulas might suggest. Starting from materials like these, however, chemical wizardry already has produced more sophisticated boron fuels, of closely guarded formulas.

Already being shipped to the United States Air Force is a liquid boron-based propellant named HEF, for high-energy fuel. It has a brown colour resembling watered-down maple syrup and come in two forms, HEF-2 and HEF-3, both of secret composition.

SENSATIONAL PERFORMANCE

Its performance is reported so sensational, increasing the range of air-breathing-engine craft by something like 40 per cent, that the Air Force wants all it can get. Developed by the Olin Mathieson Chemical Corporation, HEF is currently being made in a 15-million-dollar "semi-commercial" plant at Niagara Falls, N.Y. A 36-million-dollar plant due for completion within 18 months will bring really big-scale production.

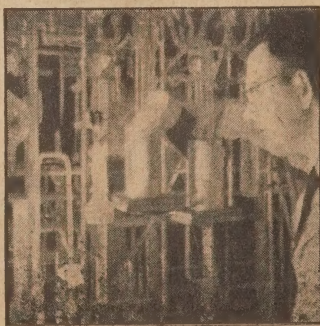
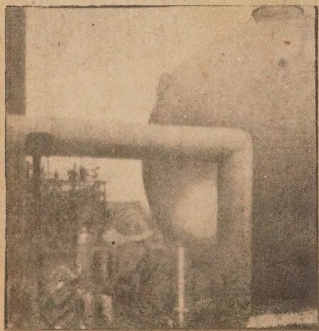
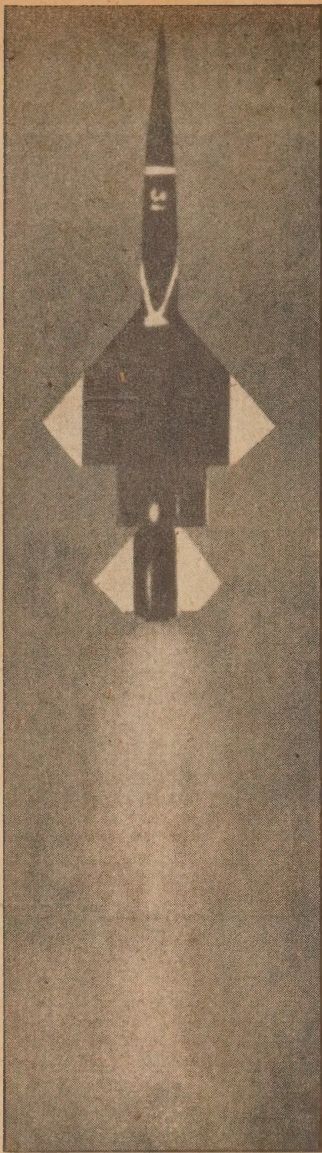
Another boron fuel named HiCal, which sounds like a vitamin and should prove so for jets, has been developed for the Navy.

It's expected to deliver 40 per cent

Rockets such as this streak skywards belching green flames from new super fuels.

Bottom left — Making HEF. The sphere holds nitrogen gas, used in secret process.

Below — HEF began in the glass apparatus of the laboratory, where this chemist is brewing successors to HEF-2 and HEF-3.



The control room, where panels show the status of each operation, is the nerve centre of the HEF plant.

Top right:—Boron comes from borax mined underground, from mines such as these. California has recently developed the world's largest open-pit mine.

ore energy than the same volume of conventional fuel, with corresponding gains in speed and range.

All that has been revealed of its make-up is that it contains boron, hydrogen and carbon. Its maker has just broken ground for a 138-million dollar HiCal plant in Oklahoma. This high-energy fuel program is called Project Zip and so the phrase zip fuels, has come into general usage.

No one else has yet come up with a phrase any more concise and apt.

Encouraged by the success of its projects to obtain chemical super-fuels, the U.S. Defence Department now is spurring the development of engines and aircraft to make the most of them. Boeing and North American are being pushed for improved designs for a "chemical" bomber, the WS-110A — so called because the craft will be driven by one of the new fuels. There has been speculation that a high-energy propellant might be able to send a bomber across the ocean and back without refuelling.

LIQUIDS TOO HEAVY

The best natural liquid fuel, petroleum — even in the refined forms of kerosene or gasoline — is much too heavy and bulky for a two-way transoceanic trip. Nature's best solid "fuel," uranium, promises unlimited range, but has still to be harnessed to aircraft in a practical way. Man-made zip fuels provide the most obvious way to boost range and performance at the present time.

Their high energy has important alternative uses. Zip fuels permit reducing a vehicle's fuel-tank space without crimping range. They make it possible to lighten fuel load, and thus increase speed. Because they burn more quickly and in less space than petroleum fuels do, they offer the possibility of shorter and lighter engines.

They raise problems, too. They burn so hotly that designers will have to provide special combustion chambers of new alloys or other materials able to withstand extreme heat.

And so far, zip fuels appear unsuited as primary fuels for turbojet engines, their solid or liquid combustion products would quickly gum up a turbojet's turbine blades.

WHENCE THE ZIP?

However, the turbojet's afterburner is essentially a ramjet, with no moving parts. A dirty exhaust doesn't hamper a ramjet a bit. So jet afterburners can use a zip fuel, with the tremendous boost in power that it keeps on tap for all-out performance.

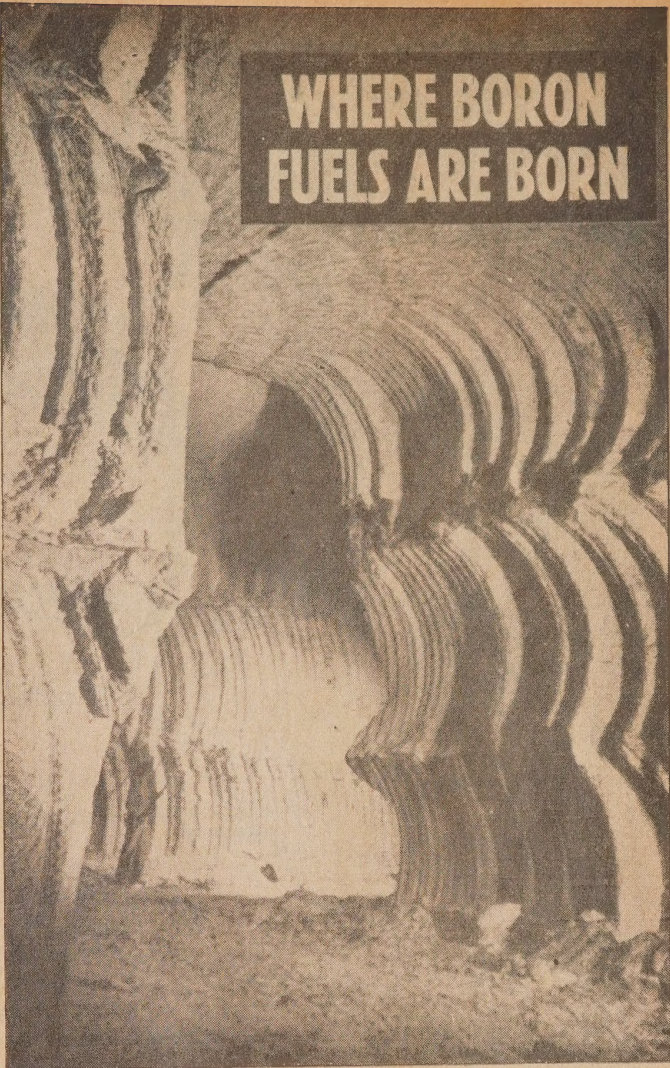
Where does the zip of the new fuels come from?

The energy of a fuel, which determines how much thrust it produces when it burns in a jet engine, depends largely on its heat or combustion.

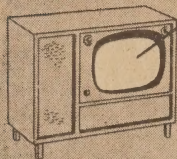
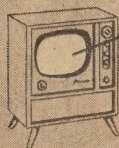
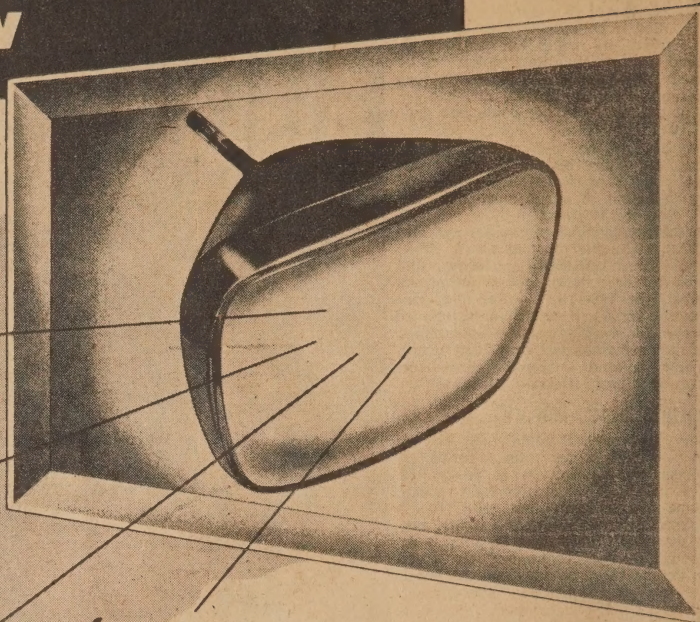
(Continued on Page 123)

Right—A possible high energy fuel is handled in a nitrogen-filled chamber lest contact with the air should ignite it. This experimenter is placing some into a "pressure bomb" to discover how sensitive it may be to explosion upon impact.

WHERE BORON FUELS ARE BORN



The 'Picture' Tube for TOP TV



*In all Good Sets-**EVERYWHERE***

Yes—that's the truth. Thomas Picture Tubes occupy an honoured place in most well-known TV sets sold in Australia to-day. Just to give you an idea—there are *many, many thousands* of Thomas Tubes giving top service and clear pictures throughout Australia right now.

Thomas Picture Tubes have a manufacturing background of experience that goes 'back to the beginning of picture-tube history. This long experience not only explains why Thomas Tubes are the first choice of so many famous-name TV set makers, but also proves that their high standards of manufacture are your best guarantee of quality and reliability.

Featuring

- ★ Aluminised Screens
- ★ Electrostatic Focus
- ★ 90° Deflection
- ★ Short or Standard Length Necks.

Quality Products
manufactured by

Thomas Electronics
of Australia Pty. Ltd.

Thomas Tubes for



TOP TV—Always

Thomas **PICTURE** Tubes

HIGHLY POLISHED NOSE CONES RETURN TO EARTH

Behind disclosures that ballistic missile nose cones have successfully returned through the atmosphere from hundreds of miles above earth, is the story of a search by technicians for the smoothest surface known.

ONLY such a surface could survive the indescribably intense heat of atmospheric re-entry.

Numerous ballistic missile nose cones have been retrieved successfully, but techniques and materials used to develop the nose-cones are top secret.

The X-17, the fastest instrumented missile ever built, has flown successfully on 92 per cent of all launches to subject different materials and shapes to meteor-like conditions. Striking deep into the ionosphere, which begins about 65 miles (104 kilometres) above earth, it has provided data of incalculable value to the rocket program.

INSTRUMENT SURVIVED

One tiny electronic instrument — a transistorised sun position indicator — survived a supersonic dive in the nose of an X-17 which ended 12ft deep in the desert sand. After being subjected to forces 1,000 times the normal gravitational pull it still functioned perfectly.

The six-ton X-17 is a three-stage projectile missile. The first stage rockets the weapon off the launching pad to an altitude of several miles in a few seconds. Coasting in a looping trajectory from the first propulsion, the rocket is projected to earth by the second and third stages.

Throughout, the flight takes little more than six minutes. Information on velocity, acceleration, heat and other subjects is continuously radioed to ground stations.

Only the super-smoothness of the polished nose cones allowed them to re-enter the earth's atmosphere undamaged.

THIS SURFACE IS REALLY SMOOTH



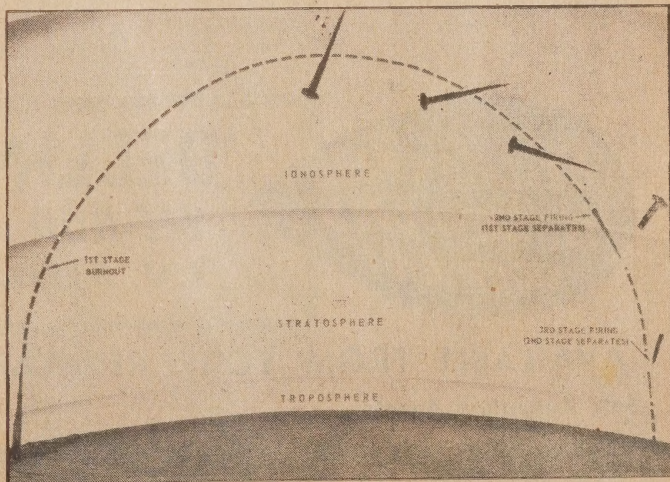
SMOOTHEST SURFACE KNOWN TO MAN—Picture shows the final precise polishing of an already incredibly smooth test nose-cone for a research missile with the photographer's image reflected.

Eliminates Need For Mica Washers

USE of hard anodising for insulating an aluminium chassis permits direct mounting of power transistors or power rectifiers to utilise the full heat-sink ability of the chassis, while providing required insulation. Dielectric tests at 500 volts indicate a resistance of several thousand megohms, which is more than adequate for existing or proposed power circuitry.

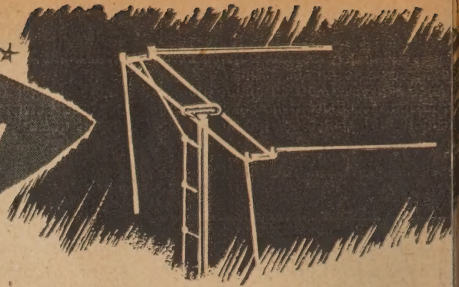
The self-insulating chassis eliminates the need for mica washers or other heat-blocking insulators between transistor and chassis when isolation is required. The resulting near-maximum transfer of heat to the chassis greatly increases the efficiency of transistor and rectifier circuits.

The new hard anodising process was developed by Hughes Aircraft Co.



TO OUTER SPACE AND BACK—An artist's conception of the trajectory of a research rocket. In the ionosphere, the tail drops because there is insufficient air to provide aerodynamic control. Back in heavier air, the nose points down and the second and third stage firings propel it to earth.

*There are
no doubts
about THIS Double-V!*



... IT'S THE RESULT OF 20 YEARS
MANUFACTURING & RESEARCH EXPERIENCE!

'BELLING-LEE' DOUBLE-V T.V. AERIALS

PERFECTED · PROVED · PREDOMINANT

Built into the "Belling-Lee" Double-V is every "know-how" learned over years in the laboratories and workshops of the "Belling-Lee" organisation

in England, and now also in Australia—pioneers in T.V. aerial construction and originators of the Vee-Rod Double-V Aerial.

● AS A RESULT

- Brilliant, unequalled performance—PROVED BY FIELD TESTS BY INDEPENDENT LABORATORIES.
- MEASURED RELATIVE GAIN compared with that of half wave-length folded di-poles is: CH2, 1.5 db; CH7 and 9, between 6 db and 7 db. Compare these results with any other published figures and you'll appreciate "Belling-Lee" superiority.

- They are easy and fast to erect. Made of high-tensile aluminium alloy, they are EXTRA STRONG; they go straight up and stay up straight. They are corrosion-resistant, withstanding all climatic conditions.
- Available in 4 alternative mountings—wall, chimney, flat roof or inside roof.
- Every aerial is individually tested and GUARANTEED in writing for 12 months, your assurance that when you install "Belling-Lee" your first cost is your last.

*"BELLING-LEE"
is the proved
DOUBLE-V!*

'BELLING-LEE'
VEE-ROD DOUBLE-V
T.V. AERIAL SYSTEMS

AVAILABLE FROM YOUR REGULAR WHOLESALER

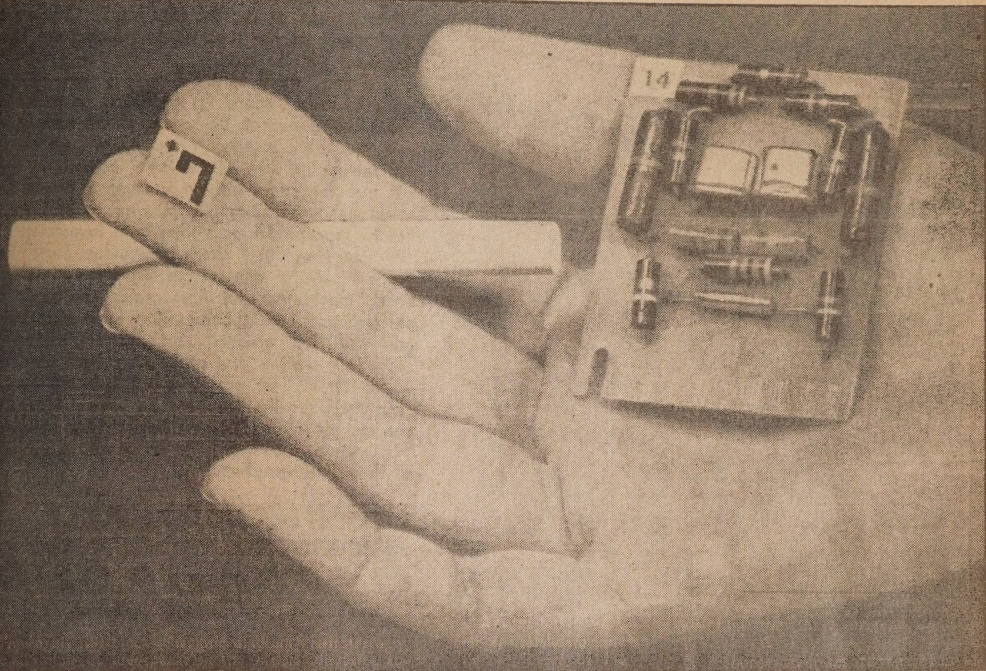
Sole Australian Agents:

R. H. CUNNINGHAM
PTY. LTD.

8 BROMHAM PLACE
RICHMOND, VIC.
JB 1614

16 ANGAS ST.
MEADOWBANK, N.S.W.
WY 0316

NEW MICROSCOPIC TRANSISTORS



Transistors as such are not new, but printed circuit transistors, each about the size of a large pin-head, make even the midget standard components look mighty! The new component—its the dot in the top left corner of the small card on this man's fingertip—is expected to greatly reduce the size of military equipment for which it was designed. Size comparisons here illustrate why the US army expects to reduce some of its equipment sizes by nine-tenths.



Mechanical arms, designed for remote handling of radioactive materials, have shown their delicate touch in many unusual feats, but this picture of an early morning shave is really too good to miss. It was taken in a British laboratory devoted to atomic research to show how completely the mechanical fingers are able to duplicate the operator's hand movements. Hmm! Wonder if there is a blade in that razor, or a doctor in the house?



HOW MUCH (or how little) Should I pay for my Tape Recorder?

THAT'S almost as awkward a question as "Which make of car should I buy?" Of course, it all turns on the purpose to which your Tape Recorder will be put.

If you intend to be a serious user—if you want to make recordings every bit as good as those issued by the big gramophone companies—if you are blessed (or cursed!) with a keenly critical musical ear—if you want something that will last for years without costing a penny for maintenance—then you'll be wise to look upon the Ferrograph 3A as a long-term investment.

We know that there are many Tape Recorders on the market costing less—some, indeed, much less. But Ferrograph standards of performance and dependability have only been achieved by making cost considerations a secondary matter. The really important question we continually ask ourselves is "Does the Ferrograph still set the standard by which Tape Recorders are judged?" We believe that it does. We believe, too, that a lot of people are proud of their Ferrographs.

THE INCOMPARABLE **Ferrograph** SERIES 3A

- Independent Motors
- Synchronous Capstan Drive
- Recording level Meter
- Uses 8½" dia. Reels
- Unique Single-knob Control
- 2 speeds with lever change
- Bass and Treble cuts
- All components tropicalised
- 2 side-by-side Tracks
- Plays British and U.S. Pre-recorded Tapes
- 2½ watts undistorted Output.
- Automatic motor cut-off

MODEL 3AN-P

TAPE RECORDERS PTY., LTD. Box 3456, G.P.O., SYDNEY.

N.S.W.: UNITED RADIO DISTRIBUTORS PTY. LTD.,
175 Phillip Street, Sydney.

AUDIO ENGINEERS PTY. LTD.,
422 Kent Street, Sydney

W.A.: LEROY INDUSTRIES PTY. LTD., 672 Hay Street, Perth.

Vic.: SIMON GRAY PTY. LTD.,
28 Elizabeth Street, Melbourne. C.1.

EVER HEARD OF SQUARE BUBBLES?



Round bubbles are produced by small boys with soap bubble pipes, and most of the time by nature. But square and rectangular bubbles were found inside lithium fluoride crystals after they had been irradiated with neutrons in a reactor, then heated to 600 degrees C. Those shown at the right were magnified more than 400 times, then enlarged in a photo enlarger.

Some things in nature seem to warrant shapes so obvious that we can't easily imagine them any other way. For instance, we just naturally think of bubbles as being round, and understandably so, for to date no one has ever seen them any other way. Until recently, that is.

SQUARE bubbles, the first such phenomena ever observed in nature, were found recently by a General Electric Company scientist during experiments at the Knolls Atomic Power Laboratory.

Peter Senio, a metallurgist at the laboratory, disclosed that brilliantly coloured microscopic bubbles in square and rectangular forms appear in lithium fluoride crystals after they have been irradiated with neutrons in a reactor then heated above 600 degrees Centigrade (1,112 degrees Fahrenheit).

Square bubbles, Senio said, never have been seen in any other material. No bubbles of any kind were discovered by Senio in lithium fluoride that was not first irradiated with neutrons.

He irradiates lithium fluoride, a clear, glass-like material, to study the effects of neutron bombardment and to associate the results with materials that make up a nuclear reactor.

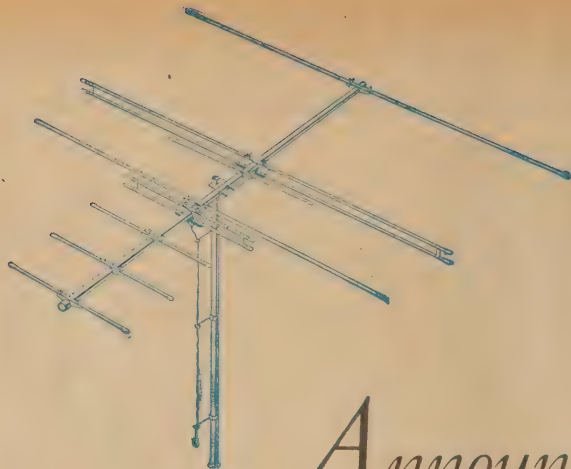
Physical changes Senio is looking for appear in lithium fluoride within a few days rather than in months, as in the case of many metals.

During his studies, Senio found that

(Continued on Page 13)



Peter Senio examines lithium fluoride crystals which, when irradiated, produce square and rectangular bubbles.



Announcing...

on 1st February, 1958

ANTIFERRENCE
(AUSTRALIA) PTY. LIMITED

open their new Victorian offices at

360 Smith Street,
Collingwood.

Telephone: JA1303

The World's Largest Manufacturer of TV Aerials

AF33/FPC

RADIATION IN OUR EVERYDAY LIFE

There is nothing new in being radioactive. Even our most remote ancestors must have had small quantities of radioactive forms of potassium and carbon in their bodies, as well as much smaller quantities of radium. From this radioactivity which they carried round with them, they were exposed, as we are, to high-energy radiation.

By A. W. HASLETT

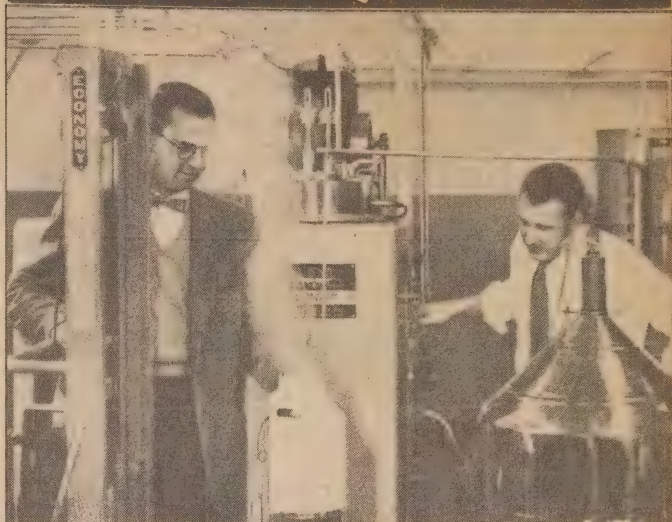
IN the bricks, mortar and wood of our houses, there is further natural radioactivity; and from outer space there bears down on us a sparse but steady hail of still more penetrating radiation.

To these natural sources, man has added others in the present century—X-rays used in medicine and industry, the luminous paint of watch-dials, and television screens. Beside them, atomic energy in its peaceful uses contributes, at the present time, a source of additional exposure for groups of specialised workers in industry.

Your house, far from protecting against natural radiation, adds to it by just over 50 per cent. A typical indoor rate of irradiation in Britain is 0.078 roentgens a year, but that out-of-doors is only 0.048 roentgens.

Radio-activity within the human body is probably highest in bone; it is here that radium—contained in minute quantities in food and drinking-water—tends to accumulate. In an adult of average age, it amounts to roughly half the indoor rate of irradiation from outside the body. But all parts of the body are radio-active; for instance, radio-active

YOU CAN BUY LIQUIFIED HELIUM



The vapor cloud shown in this picture is not steam but is rising from liquid helium. Helium liquifies at minus 452 degrees F, producing the lowest temperature yet attainable by man. It is being transferred from the cryostat into a special container at the Lockheed works in California. It was bought by a firm engaged in atomic research work.

potassium, present in all tissues, contributes a relatively large amount.

Of man-made contributions to radiation, the most important has been the increasing use of diagnostic X-rays. But in most countries this is still well below the natural dose-rate; the effect in Britain is to add over a quarter to the natural dosage. Television, already mentioned, is not a very serious offender. Averaged over the whole population, it adds less than 1 per cent to the total.

More recent sources of radiation include atomic energy industry and research. These affect only comparatively small groups of workers, not all of them concerned directly with atomic energy. For example, in the laboratories of industrial firms, as well as universities, there are many machines which accelerate nuclear particles to high energies. Their uses range from research on the forces that hold atoms together to the experimental preservation of foodstuffs.

In atomic energy proper the main sources of radiation arise from the fuel elements used in nuclear reactors. Not only do these fuel elements become highly radioactive during use but it is necessary to process them after use. Both while in the reactor and in subsequent treatment there is need for stringent health precautions at all stages. But in all these cases those responsible for the work are familiar with the problems of radiation.

SIMPLE PROTECTION

The extent of protection that is required depends on the nature of the radiation in the particular case. Radiation is taken for this purpose to include the particles that are emitted when atoms break down radioactively, as well as X-rays and radiation of the same kind as X-rays that some radioactive materials give out.

The simplest of all means of protection is to keep as far away from the source as possible. At double the distance the intensity of radiation is reduced to a quarter; at four times the distance to a sixteenth. The other general rule is that protection by intervening material depends on the sheer mass of material used.

Neutrons, produced in the working of

WHO EVER HEARD OF SQUARE BUBBLE

(Continued from Page 11)

lithium bubbles appear first in bright colours. The colours, he said, show that these bubbles have a third dimension, even though they are extremely thin, measuring only about three one-hundred-thousandths of an inch.

As the bubbles thicken, they turn white.

Senio said he believes formation of helium and tritium gases in the irradiated lithium is responsible for the bubbles. So far, however, he is at a loss to explain why square and rectangular bubbles appear rather than conventional spherical ones.

At first glance the box-like bubbles have no practical value but should lead to important scientific findings regarding the fundamental atomic structure of matter.

"It will take a lot of study to explain why nature allows bubbles of this type to form in one material and not in others," he said.

These unique bubbles are formed this way:

Small pieces of clear lithium are irradiated with neutrons in a reactor. Once irradiated they turn black.

Next, these crystals are heated in a laboratory furnace. When they reach

about 450 degrees Centigrade (842 degrees Fahrenheit) they turn clear, or almost clear, again.

When heated to about 700 degrees Centigrade (1,292 degrees Fahrenheit) for several hours they look frosty to the naked eye. At this stage they are taken from the furnace and allowed to cool. Studied under a microscope, the crystals reveal colour squares formed inside and most frequently along natural faults in the lithium fluoride crystals. Overall appearance of groups of the bright bubbles is somewhat similar to squares used in stained glass windows arranged in cubist design.

If the temperature of the furnace is boosted above 700 degrees Centigrade the bubbles inside the crystals turn white and their corners begin to round.

As the melting point of lithium fluoride, 842 degrees Centigrade (1,547 degrees Fahrenheit), is approached the bubbles grow and combine to form new shapes that resemble sausages, doughnuts, boomerangs and many other familiar objects.

Ultimate form of the bubbles during heating near the melting point of the crystals appear to be spherical, as would be expected.

ONLY **National** HAVE UPRIGHT or FLAT

POWER TRANSFORMERS FROM 30mA to 280mA

TYPE		PRIM- ARY	mA	A.C. H.T. VOLTS	FILAMENT RATINGS			MOUNTING		
RADIO										
U	or	30/150	230/240	30	150/150	6.3v/1.7a			Midget	U or F
U	or	F40/150	"	40	150/150	6.3v/2a			Upright	or Flat
U	or	F40/285	"	40	285/285	6.3v/2a	5v/2a		Upright	or Flat
U	or	F40/325	"	40	325/325	"	"		Upright	or Flat
U	or	F50/225	"	50	225/225	6.3v/2a	6.3v/2a		Upright	or Flat
U	or	F60/285	"	60	285/285	6.3v/2a	5v/2a		Upright	or Flat
U	or	F60/325	"	60	325/325	"	"		Upright	or Flat
U	or	F60/385	"	60	385/385	"	"		Upright	or Flat
U	or	F80/285	"	80	285/285	6.3v/2a	6.3v/2a	5v/2a	Upright	or Flat
U	or	F80/325	"	80	325/325	"	"		Upright	or Flat
U	or	F80/385	"	80	385/385	"	"		Upright	or Flat
U	or	F100/285	"	100	285/285	6.3vct/2a	6.3v/2a	5v/2a	Upright	or Flat
U	or	F100/325	"	100	325/325	"	"		Upright	or Flat
U	or	F100/385	"	100	385/385	6.3vct/2.5a	6.3v/2a	5v/2a	Upright	or Flat
U	or	F125/285	"	125	285/285	6.3vct/2a	6.3v/2a	5v/2a	Upright	or Flat
U	or	F125/325	"	125	325/325	"	"		Upright	or Flat
U	or	F125/385	"	125	385/385	6.3vct/2a	6.3/5a	5v/3a	Upright	or Flat
U	or	F150/285	"	150	285/285	"	"		Upright	or Flat
U	or	F150/325	"	150	325/325	"	"		Upright	or Flat
U	or	F150/385	"	150	385/385	"	"		Upright	or Flat
U	or	F175/425	"	175	425/425	6.3vct/3a	6.3/2a	5/3a	Upright	or Flat
U	or	F200/385	"	200	385/385	6.3vct/3a	6.3/3a	5/3a	Upright	or Flat
U	or	F250/385	"	250	385/385	6.3vct/4a	6.3/3a	5/3a	Upright	or Flat
TELEVISION										
		PRIMARY		mA	A.C. H.T. VOLTS	FILAMENT RATINGS			MOUNTING	
TV275/260		200/220/240		275	260/260	6.3v/4a	6.3v/4a	6.3v/5v/3a	Upright or Flat	
TV280/210		210/220/240		280	210/210	6.3v/5a	6.3v/5a	6.3v/0.6a	Flat	
RH275/295		210/240		275	295/295	12.6vct/4.5a		5v/3a	Upright or Flat	

National

NATIONAL POWER TRANSFORMERS
Manufactured by specialised factory employing the latest winding techniques and embodying the best materials consistent with modern practice. They are used exclusively by many of the largest radio and television manufacturers. Ask your supplier for full details now.

FILTER CHOKES

Have many quality features and possess the utmost in filtering qualities. Using the latest winding techniques, and incorporating the best materials, they ensure and maintain the highest possible standard in overall performances. Ask your supplier for full details now.

TYPE	INDUCTANCE in HENRIES	mA	OHMS D.C. RESISTANCE
RADIO			
B.14/60	14	60	520
C.20/60	20	60	500
D.30/60	30	60	600
C.15/80	15	80	430
E.20/80	20	80	300
E.30/80	30	80	380
F.15/100	15	100	300
F.15/125	15	125	250
F.15/150	15	150	200
F.12/175	12	175	160
F.12/200	12	200	125
F.12/250	12	250	133
Television			
RH1/275	1	275	70
TV3/275	3	275	60

Sole Australian Agents—

Wm. J. McLellan & Co. Pty. Ltd.
126 SUSSEX STREET, SYDNEY, BX 1131

DISTRIBUTORS IN ALL STATES

Electrons take over Where X-rays leave off

Our cover picture: Borrowing techniques from the X-ray field, this new tool of science employs an electron beam to reveal fantastically thin deposits or changes in the nature of a surface. It will speed research by eliminating the waiting periods necessary for deposits to become thick enough for examination by other means.

"Why did the paint peel off the automobile?"

"Why did the gas pipe rust through?"

THE answer to these and many other questions are being studied by users of the unit, which "bounces" a stream of electrons off the surface of various materials and produces a characteristic pattern that can be used to guide the development of better manufacturing processes and materials.

It is also expected to prove useful in such fields as lubricating oil, films, metal-plating, powder metallurgy, boiler scale formation, and catalyst behaviour.

The Electron Diffraction Instrument is similar to X-ray diffraction apparatus. The basic and vital difference is that electrons penetrate much less than X-rays. As a result, the chemical composition and crystal structure of a substance's surface can be determined more effectively.

Electrons can detect samples as thin



Electrons are revealing the answers to problems that have been plaguing manufacturers for years, thanks to the Electron Diffraction Instrument, announced recently by the International General Electric X-ray Department.

as 15 angstrom units (4 millionths of an inch), permitting electron beam transmission through very thin surfaces. Diffraction patterns so produced usually require exposures of only one second to two minutes.

The specimen is positioned by means of a manipulator. The resultant diffraction pattern can be observed on the fluorescent screen and photographed with the camera mechanism. Five exposures can be made at one loading of the camera.

HIGH TEMPERATURE

A high temperature furnace for studying changes in specimens at variable high temperatures up to 1,000 degrees centigrade is available as an auxiliary device for the Electron Diffraction Instrument.

About the size of a conventional cigarette lighter, the unit incorporates a cylindrical ceramic body into which is embedded a heater coil and a thermocouple. The specimen tray and several other components are made of tantalum to utilise this metal's good conductivity and high melting point.

Because electron diffraction "completes the picture," it is expected that this technique will receive the wide application to industrial problems now realised by X-ray diffraction. The advantages can be summarised as follows:

(1) Electron can be diffracted by shorter atomic crystal plane spacings. This is because, for practical accelerating voltages, electron wave-lengths are

about 1/20 that of X-ray diffraction. As a result, crystal-size estimates for a smaller size range can be determined.

(2) The electron beam is much easier to collimate and reduce in size than the X-ray beam.

(3) Sharper patterns are possible because the electron beam is highly monochromatic. And patterns can be seen visually on a fluorescent screen. Therefore, it is not necessary to photograph the pattern for some types of routine control work.

Starting with the electron gun, the filament operates at a fixed potential, variable from 20 to 50 kilovolts and negative with respect to ground. To obtain a more constant temperature, the filament is heated with separate radio frequency source.

The resulting electrons are accelerated through a grounded apertured anode and focused on a fluorescent screen in the camera chamber by means of an electro-magnetic focusing coil.

POSSIBLE USES

An instrument capable of chemically analysing as minute an amount of material as five micro-micro grams will naturally lend itself to many research and production applications. Here are a few:—

Corrosion: The losses due to corrosion are tremendous. Thus, the need to study its cause in the very early stages. The electron diffraction instrument will detect the first changes and help identify

the chemical nature of these changes before they are visible with a microscope or detectable by other means. Such analysis has helped in the selection of the best material for gas-turbine buckets.

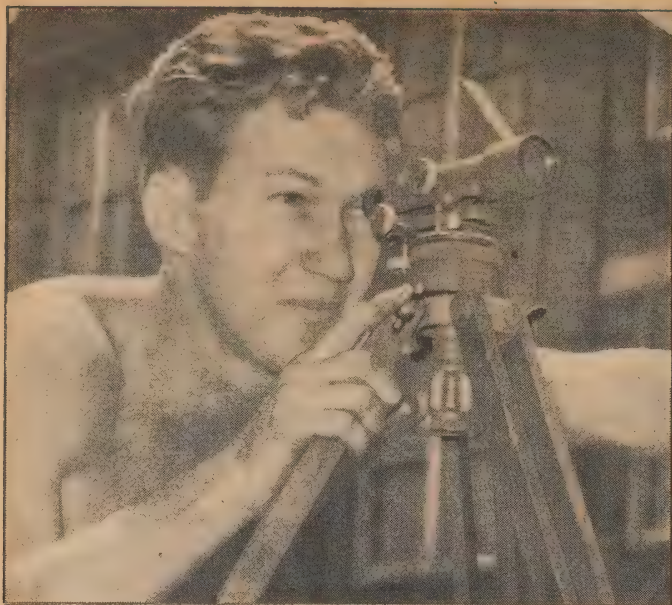
Catalysts: Catalytic action is a surface phenomenon. Therefore, the detection and measurement of material forming the surface is of vital importance. Conventional methods of analysis may show one chemical composition, whereas electron diffraction photographs reveal a very thin layer of another material responsible for the catalytic action. Thus, the electron-diffraction instrument permits closer study of surface conditions for early determination of poisoning and better control of catalysts.

LUBRICATION

Lubricants: Lubrication is a function of the surface film. What changes occur in oil films determine the efficiency of running machinery. Thus the importance of the electron-diffraction instrument in determining good lubricating films and control processes for their production. In addition, the instrument is useful for studying surface changes in bearings and cylinder walls, and for detecting and studying preferentially deposited oil films.

Metallurgy: The interaction of thin films of metals can be studied and used as a control for the processes of making alloys. For example, a thin film of nickel was deposited on a sample holder and

(Continued on page 119)



One wonders how modern surveyors and engineers would have tackled some of the jobs which faced their ancient counterparts. The latter had one big advantage—they did not have to worry overmuch about labour and working conditions!

With all the devices of modern engineering, such as steel cables, hydraulic jacks, cranes and steam winches, the task of re-erection proved extremely difficult.

Yet the ancient Romans carted these obelisks away by the dozen and re-erected them in other lands.

The way these columns were made and erected in the first place is an interesting story.

LABOUR WAS CHEAP

As usual, the "machines" used were men. Labour was cheap in those days and, with the aid of all kinds of "ingenious" schemes such as the lash, the rack and hot branding irons, no difficulty was found in getting the workers to co-operate. With these inducements hundreds of thousands of workers "volunteered" for those interesting jobs such as digging trenches, carrying huge stones and the like.

At the stone quarries a flat surface was prepared and marked out with the shape of one side of the obelisk. A trench was then dug completely round it and two sides and the top finished off.

The surfaces of the obelisk were not finished smooth with hammers and chisels but were rubbed down with lumps of stone called dolerite, which was found nearby and is of extreme hardness.

When the three sides were complete the stone was undercut and freed from the mass to which it was attached.

The finished obelisk was then worked on to a sledge by means of levers so that the bottom came uppermost. It

Manpower No Object To Ancient Builders

In the October issue we glanced into past history and outlined some of the methods used by engineers of ancient times to erect the huge structures for which they were famous. It seems characteristic of those times that, although they were extremely limited by lack of efficient labour-saving machinery, the builders never hesitated to tackle the most complicated and even colossal tasks.

PERHAPS one of the most difficult tasks for any engineer is to erect in a vertical position from the horizontal a heavy pole constructed in one piece.

In modern times if a column, say, 137 feet long, weighing 1,100 tons, was to be erected, it would be done piecemeal either by fabrication of a large number of steel parts riveted together or by progressive stages of concreting or cementing together of bricks or blocks of stone.

A COMMON SIGHT

Have you ever watched the erection process of a common telegraph or electric light pole? This measures some 25 or 30 feet and about 12 inches in diameter. Sometimes half a dozen men are employed with spiked props, gradually easing the pole into a vertical position. At times a crane is used instead.

On the one hand, without a machine,

it is no mean task for six men, whilst on the other hand a rather complicated machine must be used.

The difficulties which must have beset the builders of ancient times in the erection of these vertical columns or obelisks are emphasised by the task involved some years ago in the removal of two of these from Egypt and their re-erection on another site.

Both obelisks weighed some 200 tons each. One was re-erected in London and another in New York.

was then finished off and dragged by thousands of men down to the bank of the Nile, where it was transferred to a barge which carried it to another point of the river bank. The obelisk was again transferred to another sledge and hauled to the site of erection.

ERECTING AN OBELISK

The erection of the obelisk into a vertical position was a task of some magnitude. Use was made of the inclined plane in a similar manner to those used in the erection of the pyramid.

A stone platform was built around the spot where the obelisk was to stand and to a height about two-thirds that of the obelisk. The sides of this platform formed a hollow rectangle with the inner sides sloping downwards and inwards until they met the sides of a stone pedestal at the bottom on which the obelisk was to rest.

by Calvin
Walters

On one side of the stone structure two holes were made and temporarily sealed. The hollow of the structure was then filled with sand to the top.

From the top of the platform an inclined plane sloped to the ground at an angle suited to the hauling, bottom end first, of the obelisk to the top of the platform.

When all was in readiness, bands of "willing" workers hauled the obelisk to the top of the platform until the bottom end rested over the centre of the sand-filled hollow platform. The openings at the base of the platform were then unsealed and the sand allowed to run out a little at a time.

SAND REMOVED

As the level of the sand fell in the platform, so the obelisk sank, with the edge of the platform as a fulcrum.

Thus the obelisk was gradually eased into position on its stone pedestal, where a notch was provided into which the butt end of the obelisk fitted. It was then hauled into a vertical position by means of ropes attached to its top.

When the job was completed the stone platform and inclined plane were removed.

To give some idea of the magnitude of the task which the ancient Egyptians carried out in erecting their obelisks, comparison should be made with the way an obelisk in Rome was shifted to a new position only 800 odd feet from where it stood.

This obelisk was originally brought to Rome in the first century B.C. by the Emperor Claudius, where it was set up in the Circus of Nero.

By the year 1585 all evidence of how it was erected in its position in Rome had vanished and no one knew how to go about shifting this 88ft high column weighing some 300 tons.

Pope Sixtus 5th wanted the obelisk shifted to the Vatican grounds. A competition was arranged with a prize for the winner presenting the best method of removal. This was won by a chappie named Dominicus Fontana.

Heavy scaffolding was erected around the obelisk to a height of 90 feet. The scaffolding consisted of oak timber 40 inches square.

A ramp was built to the new site and stout hemp ropes manipulated over capstans lifted the obelisk two feet off the ground.

FORTY CAPSTANS

Forty capstans were used, operated by 400 men and 80 horses and the obelisk was levered from its foundations with five levers 40 feet long.

The preliminary work took seven months to finish.

After lifting the obelisk the required two feet, it was lowered on to a cradle amid a deathly silence from the huge crowd of Romans assembled to watch the proceedings. This deathly silence was not entirely spontaneous as sentence of death had been pronounced on any one who made any noise during the delicate operation. Such pronouncements usually have a marked effect on people.

The obelisk was then drawn along the ramp on its cradle and it took another eight days to erect the obelisk into its new position.

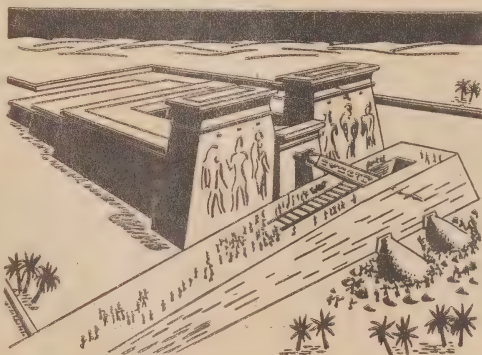
During the progress of the work, disaster threatened when a hemp rope began to stretch. A sailor in the crowd, no

doubt because of his seafaring experience, shouted to wet the rope. This was done and the rope contracted. By his disobedience of the injunction for silence the sailor risked his neck. Fortunately, the success of his suggestion earned him a reprieve and he was duly rewarded, by he and his family forever being allowed to supply the palms for St. Peter's Cathedral on Palm Sunday.

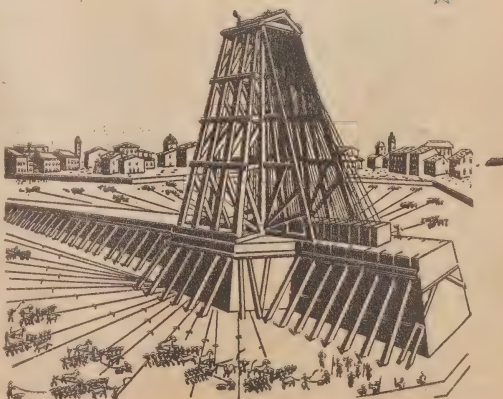
Thus, it will be seen that the Romans, even with their much greater advancement, found it a difficult task to handle such great objects as these obelisks which the ancient Egyptians seemed to have handled with such skill that erecting them seemed to have been somewhat of a popular pastime.



Claimed as man's largest constructional feat, the great wall of China stretches a thousand miles across mountains and valleys to the sea. It was an effective barrier against marauding bandits but offered little hindrance to an organised Army under Genghis Khan.



Fontana made history in Rome with this method of lowering and re-erecting the Vatican Obelisk. It involved a huge timber structure and forty capstan manned by 400 men and 80 horses. At one critical stage near disaster was averted by the sailor's trick of dampening a sagging rope to make it taut.



So it is that we find the most ancient peoples devoting their time to the completion of some of the most formidable tasks ever attempted by man.

The instruments used for measuring and plotting were in the main most primitive and it was not until the period immediately prior to the Christian era that we find more advanced instruments used for levelling, surveying, and so on.

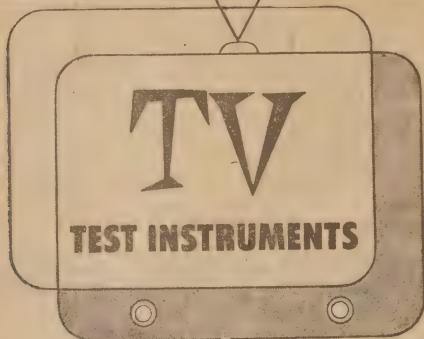
For their surveying and engineering work in the construction of roads, tunnels, aqueducts, and so on, the Greeks and Romans used three instruments.

These were the Groma, the Dioptra, and the Chorobates. The Groma, pictured elsewhere in this article, was used for the plotting of right angles. It con-



Here's how the Egyptians erected the huge vertical obelisks for which they were famous. As illustrated in an earlier article, they were dragged up a slope to a sand-filled rectangle containing the base on which the obelisk had to rest. The sand was then gradually run out, allowing the obelisk to settle into position.





by **UNIVERSITY GRAHAM**

Pattern Generator, Model TVR-PG (Below)

This instrument is one of the basic instruments required for testing and adjusting TV receivers, and produces RF or IF carrier waves, amplitude modulated by video signals to produce horizontal bars, vertical bars or cross dot pattern, comprising both horizontal bars and vertical rows of dots. The carrier frequency is from 30 to 40 and 50 to 110 megacycles in fundamentals, and 100 to 220 megacycles in second harmonics. Horizontal bars from 8 to 10 are available and vertical bars from 8 to 12. On cross dot pattern the number of horizontal bars can be varied from 7 to 20 and the number of vertical rows of dots from 8 to 12 by means of controls provided. Many new features make this attractive for TV service organisations.

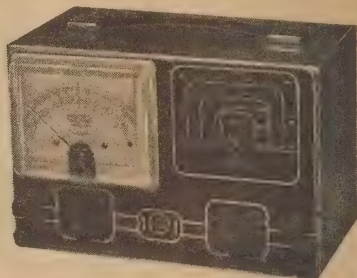


5 NORTH YORK ST., SYDNEY. BU3169

WRITE FOR DETAILS OF THE
INSTRUMENTS THAT INTEREST YOU

Multimeter (20,000 ohms per volt) Model TVR/MM

This new Multimeter, built to the standards that University Instruments have laid down for many years, is designed as a quick checking portable instrument for TV and radio servicemen to carry with them. A.C. voltages, D.C. voltages and output voltages may be checked in ranges of 3, 10, 30, 100, 300 and 1,000 and there are six ranges of D.C. current from 100 microamperes up to 10 amperes, 5 ohms ranges allowing resistances from one half ohm up to 20 megohms to be checked are obtainable with self-contained batteries, and the large W4 all polystyrene meter is employed. Light in weight and readily portable, this rugged multimeter will be handy for all types of service.



Resistance Capacity Tester, Model UBA

With the complex circuits in TV receivers employing many capacitors and many resistors, this special instrument provides a good standard of accuracy together with ease of handling. It covers an extensive range of resistance measurements from 1 ohm to 10 megohms and capacity measurements from 10 micro-microfarads to 10 microfarads. It is accurate and sensitive and is overload proof. A calibration system is incorporated to enable rapid checking of the apparatus of any instrument, and internal standards are adjusted to an accuracy of plus or minus 1 per cent.



MAIL THIS COUPON TODAY:-----

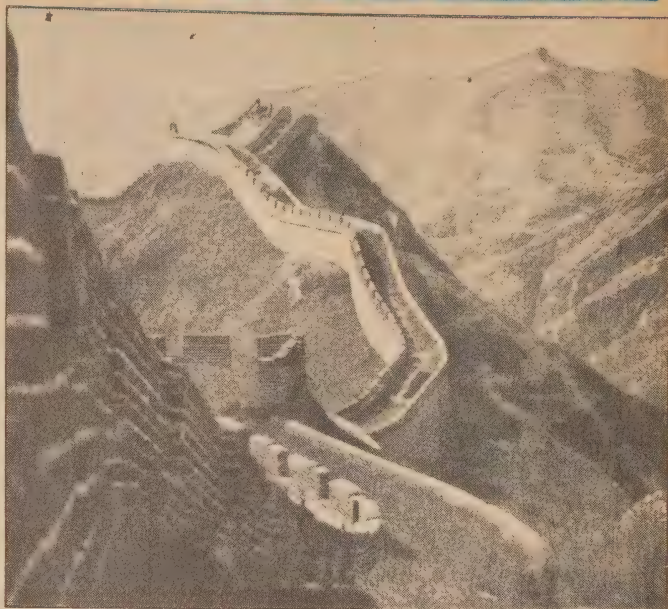
To: University Graham Instruments Pty Limited,
5 North York Street,
SYDNEY

Please place me on your mailing list for TV
and radio test equipment.

NAME _____

ADDRESS _____

GREATEST CONSTRUCTION FEAT



This picture gives some idea of the way in which China's Great Wall follows the countryside over valley, plain and mountain. It has long since fallen into disrepair but much of the structure still remains.

sisted of two pieces arranged horizontally in the form of a cross, suspended in the centre from a pivot fixed to a vertical stem.

From the four ends of the cross-arms were suspended a plumb line with the weighted bob on the lower end.

The ancient writer Frontinus describes the use of the instrument as follows:—

Set the stem in the ground or support it in some convenient manner. Then "we must steady the plumb lines and look at the cords of string stretched by the weights, setting them in a line until the eye sees the nearest only. Then put in the stakes, and, having carried the apparatus to the last stake, set up as before, and look at the stakes in the opposite direction by way of a check. Then, to continue the staked out line when interrupted by obstacles, carefully set out the right angles given by the plumb lines by perpendicular lines at every point of intersection."

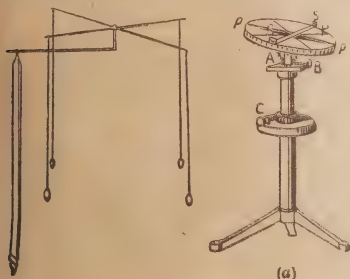
TROUBLE WITH WIND

Sometimes difficulty in steadying the plumb lines was experienced, especially in the wind, but it was, nevertheless, very widely used.

Another instrument which was used for setting out lines at right angles to each other and for other surveying work was the Dioptra. This was invented almost 2,000 years ago, and was the forerunner of the surveyor's theodolite as used today.

The instrument is illustrated here and will be seen to consist of a circular plate graduated in degrees round its edge. There is a bar pivoted at the centre, containing cross wires at each end. A pointer mark *pp* is arranged at right angles to the pivoted cross bar.

Adjustment of the horizontal plate is made by the rack and pinion operated by knobs *A*, *B*, and *C*.



For use in conjunction with the Dioptra, was the levelling staff, also illustrated. This consisted of a graduated rod with a plumb line suspended down one side. The disc on the front face was raised or lowered over a pulley wheel mounted on the top of the staff. The disc was provided with horizontal index mark.

To use the Dioptra one man stood at some distance away holding the measuring staff whilst another man applied his eye to the cross wire lights on the Dioptra whilst operating the controls to ensure it being level. The fellow with the measuring staff raised or lowered the disc until the chappie with the Dioptra signalled that he had aligned the mark on the disc with the cross wires on the Dioptra. Readings of the graduations



Some of the surveying instruments used by ancient craftsmen. Above, the cumbersome but accurate chorobates; at the extreme left, the groma and, centre the dioptra and levelling staff forerunners of the modern theodolite and similar instruments.

water when required and the rod adjusted until the water was level at each end of the channel.

Needless to say the Chorobates was a clumsy instrument to carry around. Nevertheless, it was most effectively used for levelling and was especially used for roadmaking.

To conclude this article mention must be made of the greatest constructional work ever achieved by man. This is the Great Wall of China.

This tremendous project was begun in 240 B.C. by a certain Chin Huang Ti, and was completed about the 16th century A.D. The idea was to keep out the raiding bands of Mongols which prevented development of the country.

MAN'S LARGEST WORK

It has been rightly said that an observer on the moon looking at the earth would see only one work of man—the Great Wall of China. He would see it extending across China for a distance of 2,550 miles, which is a little more than one-tenth of the earth's circumference.

It climbs over mountains 4,000 feet high and down into valleys and deep ravines.

About 300,000 men were employed on the job in addition to all the condemned criminals and all the paupers in the empire. The wall is 25 feet wide at the base and 15 feet wide at the top and 30 feet high.

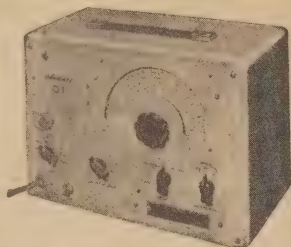
The skill with which the stones for the foundations are joined together is almost unbelievable. This was assured, however, because of an edict issued by the Emperor that any workman leaving

(Continued on Page 123)

“ADVANCE”

MODEL Q1

SIGNAL GENERATOR



PRICE: £74/12/- (Plus Tax)

Available on Hire Purchase Terms

- ★ A Robust Instrument for both F/M, Sound and Television Receiver Servicing.
- ★ Facilities to Deal With All Australian TV Channels.
- ★ Precision at Low Cost!

This instrument, which employs accepted standard signal generator techniques has been designed and produced to provide a simple-to-use, yet accurate instrument at a price within the reach of every service man.

NOTE THESE FEATURES !!

- ★ T.V.-IF STRIP SPOT ALIGNMENT.
- ★ MARKER GENERATOR FOR SWEEP ALIGNMENT.
- ★ SQUARE WAVE MODULATION (INTERNAL) GIVES HORIZONTAL BAR PATTERN.
- ★ STAGE GAIN MEASUREMENT WITH ACCURATE ATTENUATION.
- ★ COVERS 7.5 TO 250 Mc/s IN FIVE RANGES ON FUNDAMENTALS.
- ★ SQUARE WAVE RESPONSE OF IF STRIPS.
- ★ CALIBRATION ACCURACY $\pm 1\%$.
- ★ LEAKAGE LESS THAN 3 MICRO-VOLTS.
- ★ SMALL, LIGHT AND PORTABLE (WEIGHT 17lb).
- ★ DIRECTLY CALIBRATED DIAL WITH $37\frac{1}{2}$ INCHES OF SCALE.

Obtainable from the Sole Australian Agents:—

JACOBY, MITCHELL & CO. PTY. LTD.

477-481 KENT STREET,
SYDNEY

PHONE MA 8411 (5 LINES)

DISTRIBUTORS IN ALL STATES





Technical Review



Cardiac instrumentation in use. On top, the 5ft high cart, an area free from the danger of explosion, are a Defibrillator-Pacemaker (single unit at left) and a dual-trace cro. Electrocardiophone mounts on lower shelf due to its explosion-proof construction.

Under normal conditions, the heart rhythm is relatively constant and tends to be accepted as background noise. However, any significant change in this rhythm is forcefully brought to the anaesthesiologist's attention.

ELECTRICAL OPERATION OF THE HEART

Muscular as well as nervous action is accompanied by an electric potential generated across the organ in question. Since a heart beat consists of synchronous action of the muscles and nerves of the heart, each heart beat is accompanied by the generation of a rather large rotating vector

One way to measure this vector is to sample the potential it generates between various points on the body as a function of time. For monitoring purposes, the potential generated across one set of points, usually the patient's right and left shoulders is used.

A normal heart signal, as measured between these two points, is shown in Fig. 1A. The signal has three distinct parts, the P, QRS and T modes. These components correspond to the contraction of the auricles, contraction of the

TONES MONITOR THE HEART'S ELECTRICAL ACTION

The use of electronics in medicine is now wide-spread: Specialised designs allow diagnosis and treatment impossible in earlier days. The device described here, uses a neon-tube oscillator, the frequency of which is controlled by the amplitude of an electrical signal from the heart. The resulting tone series gives the surgical team a constant check on the heart. Explosion-proofed circuitry includes a low distortion differential preamplifier. (Article from "Electronics")

CONTINUOUS monitoring of the heart's electrical activity during surgery has long been recognised as necessary. The problem in such monitoring is not simply that of separating the heart's electrical activity from local interference and amplifying it, but one of presenting the information to the anaesthetist in such a way that it will give him instantaneous warning when abnormalities occur, yet provide a minimum of distraction at all other times.

The monitor should be portable, explosion-proof, operate reliably in the presence of severe electrical disturbances and produce an undistorted signal for visual observation on an oscilloscope or an electrocardiographic recorder.

The instrument to be described derives its input from two leads typically connected to the patient's right and left

shoulders. These leads pick up an electrical signal originating in the heart and connect to a differential preamplifier with 30 μ V sensitivity and frequency range of 0.08 cps to 80 cps.

HEART RHYTHM

The amplified signal is used to produce a frequency-modulated audio tone centred at 2,000 cps. The frequency deviation of this tone is roughly proportional to the amplitude and polarity of the input signal. Normal heart rhythm results in three short bursts of sound, each at a different frequency, and each corresponding to a particular mode of the heart's electrical activity, the P, QRS, and T modes. These sounds may be reproduced by a small loudspeaker built into the instrument or may be monitored by the anaesthetist alone with headset.

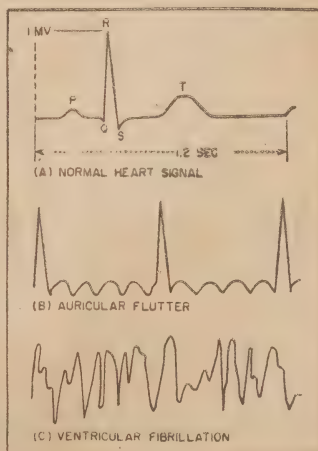


FIG. 1—Potential across shoulders caused by normal (A) and malfunctioning (B, C) heart. Differences must be detected.

acos

A COMPLETE RANGE

CRYSTAL MICROPHONES MICROPHONE INSERTS

FOR EVERY PURPOSE



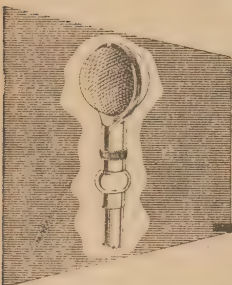
DESK or HAND MICROPHONE, MIC36

This Microphone is ideal for home recording and public address, etc. Response unexcelled for its size and price. The performance is not affected by vibration, shock or low frequency wind noise. Omni-directional frequency response substantially flat from 30 to 7,000 c.p.s. Recommended load resistance not less than 1 megohm, dependent on low frequency response. Can be supplied complete with switch and floor stand adaptor, as required, at a small extra cost. **PRICE, £6/18/6.**



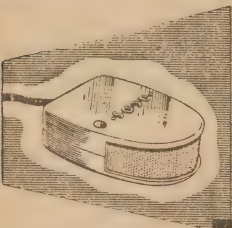
TABLE or STAND MICROPHONE, MIC22

This omni-directional Microphone is robust in construction, with a pleasing appearance. Vibration, shock or low frequency wind noise will not affect the performance. The low frequency cut-off is dependent on the load resistance. The cut-off is given by the equation, $F = 80 \text{ divided by } R$, where $F = \text{c.p.s.}$, $R = \text{megohms}$. An adaptor (floor mounting) is available at low extra cost. **PRICE £9/18/6.**



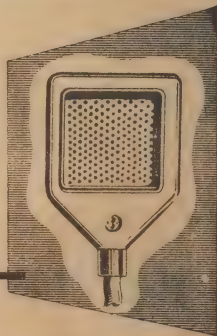
HIGH-QUALITY MICROPHONE, MIC16

This Microphone incorporates the world-famous floating crystal sound cell construction. Its fine performance is not affected by vibration or shock. The fidelity is not impaired by low frequency noise. **PRICE, £24/19/6.**



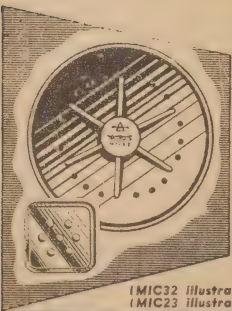
LAPEL MICROPHONE, MIC28

Designed to give freedom of movement, this Microphone is small and non-directional. Housed in a soft, moulded-rubber case, which gives protection against shock, it is provided with a pin at the rear of the case for pinning to the lapel. **PRICE, £5/19/6**



GENERAL PURPOSE, MIC35

The MIC35, is ideal for amateur transmitters, public address, etc. Housed in an attractive die-cast case, it features a high sensitivity and substantially flat characteristics. Provided with a built-in shunt resistance of 2 megohms, it will, when connected to the grid of the input valve, give a substantially flat response from 50 to 5,000 c.p.s. **PRICE, £2/15/-.**



HAND or DESK MICROPHONE, MIC33

This Microphone has been designed for the high quality public address and home recording field. High sensitivity and flat characteristics are obtained by a specially designed acoustic filter. Housed in an attractive plastic case with an unexcelled response for its size and price. Unaffected by vibration, shock or low frequency wind noise. Omni-directional frequency response substantially flat from 30 to 7,000 c.p.s. **PRICE, £6/18/6.**



CRYSTAL MICROPHONE INSERTS

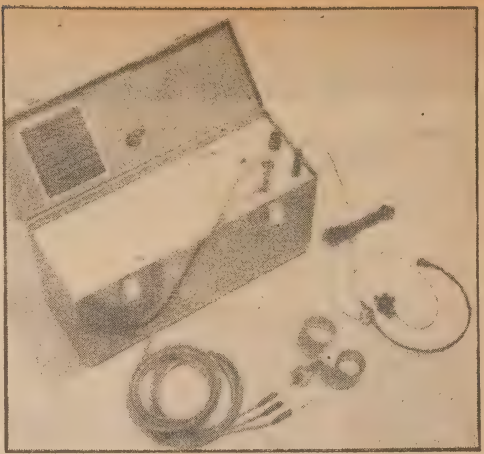
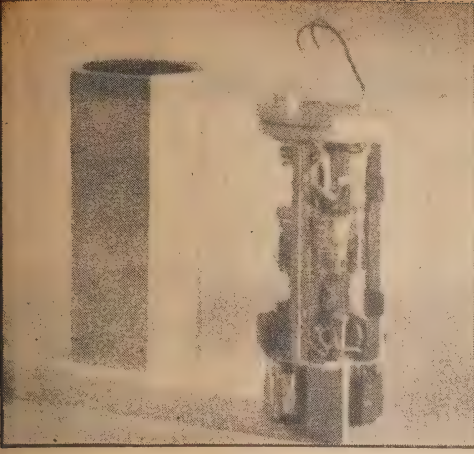
These inserts are available in varying sizes, ranging from as small as $\frac{1}{8}$ in. square to 1- $\frac{1}{2}$ in. round, with various thicknesses from $\frac{1}{16}$ in. to $\frac{1}{4}$ in. Suitable for every purpose, such as hearing aids, public address, tape recording, amateur transmitters, etc., they have responses from 2,250 c.p.s. to 3,500 c.p.s. at -5 db to -30 db. Insert can be supplied with or without 10 meg resistor as required.

MIC19/4 and MIC32, £2/15/6; all others, £1/19/6.

(MIC32 illustrated)
(MIC23 illustrated)

Sole Australian Agents:

AMPLION (A'sia) PTY. LTD. 101 Pyrmont Bridge Rd., Camperdown,
Sydney, N.S.W. Phone LA 6124.
Victorian Distributors: DISTRIBUTORS CORPORATION, 403 Bourke Street, Melbourne.

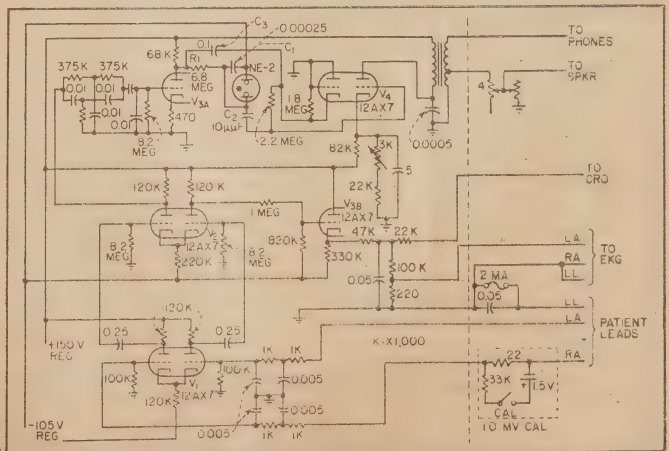


ventricles; and refilling of the ventricles, respectively.

PREAMPLIFIER

electrocardiograph for diagnostic purposes. The second output is used to actuate the tone gate.

tering in frequency but of the same amplitude, a job for which it is much better suited. Tests with the f-m system established that the ear's resolution of the three modes seemed optimum at a centre frequency of about 2,000 cycles per second. This resolution is further improved and the disturbing effect of the tone greatly reduced if the carrier is gated off at all times when the magnitude of the heart signal falls below some predetermined level.



CHANNEL MASTER

The world's largest range of TV Aerials —
Backed by the finest technical skill of America and Australia



"CITY VEE"

gives a superior gain and
directivity in a vee - type aerial



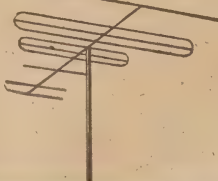
MODEL
315:R.T
PRICE
£7/5/-

This low priced aerial is proving tremendously popular. It gives excellent results in metropolitan areas covering Channel 1 through 10. People like it because it looks attractive and modern.



MODEL 310
Dual flector

Ideal for strong to medium signal areas. Makes an excellent loft aerial. Covers Channels 1 through 10.



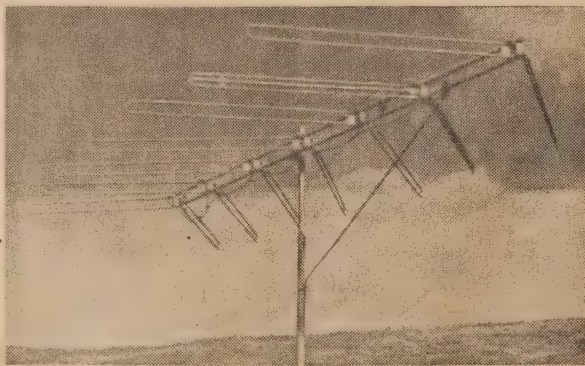
MODELS 626 - 1026
CHALLENGER

6 and 10 element composite Yagis for areas where high gain and directivity is needed. Low priced to meet and beat all competition. Cover all channels in use.



SHOWMAN

An indoor aerial masterpiece. Has fashion appeal as well as greater power than any other indoor aerial. Perfect for flats, etc., where outdoor aerials are banned.



T-W

FOR FRINGE AREAS

This revolutionary aerial provides more picture power in deep fringe areas. T-W reinforces the signal, rejects interference. 7 Element, 5 Element or 3 Element models available. The 7 Element with its amazing directivity is THE answer to those difficult suburban spots.



Model 330 Rainbow

The genuine all-channel yagi. Full band width—highest gain. The Rainbow and Super Rainbow (Model 331) are very successful and popular in fringe and deep fringe areas.



FREE! 16 page booklet "Better Pictures on Your TV Set!" Post Free.

Simply send this coupon to Channel Master

NAME

ADDRESS

RR 158

FACORY: CHANNEL MASTER PTY. LTD., 752 PITTWATER ROAD, BROOKVALE, N.S.W. :: XF0221

NEW SWITCHING TRANSISTOR'S FAST RESPONSE

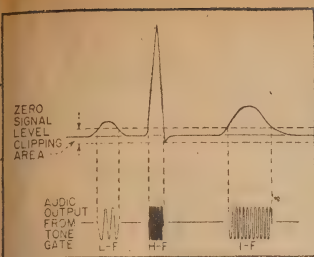


Fig. 3. Simplified tone gate output waveform. Tones are a few milliseconds apart, but may be distinguished by ear.

tial preamplifier. It is first passed through a twin-T 60-cps rejection filter and then to the grid of a third stage of amplification, V3A, which raises the peak amplitude of the signal to approximately 40 volts.

This 40-volt signal performs two functions. First, it varies the voltage across a small neon bulb oscillator, consisting of R1, C1 and the bulb. The centre frequency of this oscillator is 2,000 cps. A 40-v change at the plate of V3A is sufficient to cause approximately one octave of frequency deviation. A small sample of this frequency-modulated signal is coupled to the grid of V4B through C2.

Second, the heart signal from the plate of V3A is coupled to the grid of V4B through C3. Tube V4B is biased about four volts below cutoff, however, positive heart signals coupled to its grid drive it into the conducting region. When this happens, the f-m audio signal, also coupled to this grid, is amplified and appears at the loudspeaker and earphone output jacks. Thus, the desired audio output of Fig. 3 is obtained. The audio output is kept at constant amplitude because of grid limiting in V4B.

MECHANICAL CONSTRUCTION

Circuit components are mounted on two phenolic centre boards contained within an explosion-proof case. Components are, in most cases, connected by printed wiring. The lower deck mounts the power supply components.

The entire assembly is rigidly attached to a 1/4 in thick aluminium end plate which screws into the explosion-proof aluminium cylinder. Input and output leads are brought through the header, also explosion-proof. Power is fed into the container through a separate header. Special precautions are taken to ensure that these leads cannot become damaged in such a way as to cause sparks. The entire assembly is then packaged in an outer case. Input and output jacks and a volume control are brought to the front panel.

Packaging this circuitry in an explosion-proof container raised special thermal problems. Approximately 16 watts are used by the equipment. As much of this heat as possible is conducted to the container walls by metal elements. Since the explosion-proof container itself is well bonded to the outside carrying case, the entire surface area of the carrying case is utilised as a heat radiator. With this approach, the temperature inside the case has been kept close to 60 C with about 27 C ambient air.

NEW Switching Transistor developed by the German Post Office was described by W. von Munch at the recent International Components Symposium at Malvern. It is constructed rather like an n-p-n alloy junction transistor, with lead-antimony emitter and collector electrodes alloyed on to a high-resistance p-type base.

During the alloying process a tungsten whisker encased in a nickel tube is embedded in the collector so that it just penetrates the collector junction. When a resistance is connected in the base circuit the device has a negative-resistance characteristic rather like a point transistor (see emitter input graph). This gives a regenerative action which produces a rapid switch-over, when the emitter is suitably triggered, from a high resistance condition (right) to a low-resistance condition (left).

The electric field set up in the base region by the tungsten whisker accelerates the current carriers and thereby gives a switching time of only 0.1-0.2 u/sec.

It is notable that this high-speed response is obtained with a transistor whose base region is as thick as that of an ordinary AF transistor. Pulse repetition rates of up to 2 Mc/s can be handled by the device.

Super insulation

Half-Century Time Constant is claimed for three 1mf, capacitors, shunted by their own insulation resistance of 1.5×10 ohms, which have been on test so far for six years at the Telegraph Condenser Company.

At the beginning of the six-year period they were charged to 500 volts and are now still well above 400 volts.

The high insulation resistance has been achieved by the use of plastic film dielectrics, which are now tending to replace paper for low leakage applications.

Very thin films are desirable to reduce the size of capacitors, and development is proceeding on polystyrene films of only 0.0001-0.00025 in thickness.

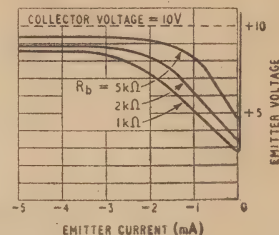
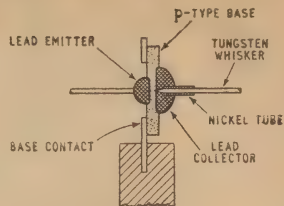
It is expected that capacitors of up to 1 mfd for operation at a maximum of 50 volts DC will be possible using metalised films of this type. These, of course, will be very suitable for transistor circuits.

Really slow speed

81 r.p.m. record development was described by Dr P. Goldmark of the Columbia Broadcasting System Laboratories at the ninth annual convention of the Audio Engineering Society held recently in New York.

These records were developed under the sponsorship of the American Foundation for the Blind, and are designed for speech reproduction.

This allows the groove amplitude to be the same as that on the 161 r.p.m. records using a 1-mil radius stylus tip also developed by the C.B.S. Laboratories for the Chrysler car record player.



The upper frequency limit is, however, halved, but for speech this limitation is not serious. A 7 in diameter record provides four hours of speech, and a 12 in record 10 hours.

The same tone arm as in the car record player is used. A viscous fluid in the vertical bearing damps out any tendency for the pickup to move relative to the record when the whole player is moved horizontally, while still providing a bearing free enough to allow the extra fine record grooves to be tracked with a stylus force of only two grams.

The pickup cartridge in the arm is balanced about a horizontal axis, and the arm itself is rigid in a vertical plane, so that vertical movement of the player as a whole does not displace the stylus from the groove.

Moreover, if the pickup is accidentally moved by hand across the playing surface only the stylus force acts on this surface, and this force is so low that any scratches produced are not audible.

Valves operate red hot

THE penetration of the "thermal barrier" in the production and use of electronic tubes appears to be in sight. An American company recently announced the development of valves, resistors, capacitors, transformers, printed circuit boards and other devices capable of operating at temperatures up to 1,500 degrees Fahrenheit.

At this temperature, conventional electronic apparatus either burns up or melts down.

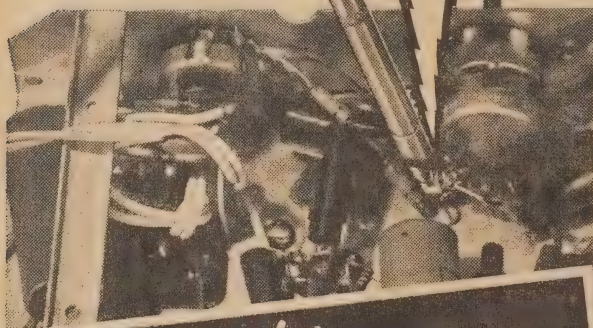
The devices, which are not being mass produced as yet, will find their first use in guided missiles and supersonic aircraft. Their use in aircraft would eliminate the need for bulky refrigeration equipment to keep the electronic gear cool enough to operate.

The new devices are made of ceramics and metal such as titanium that have high melting points. With the apparatus operating at such high temperatures, one series of valves does not need a power supply to heat its filaments.



It's EASY and SAFE

To solder in deep and awkward
places with SCOPE !



Here's why

SCOPE SOLDERING IRON

PHOTOGRAPH SHOWS IRC Continuously Compensated Variable Loudness Control in position. Write for pamphlet giving detailed description and installation instructions.

VIBROSCOPE ETCHING TOOL

gives remarkable etching results on ALL metals. Operates from Scope's Iron transformer or AC/DC sources between 3 and 4 volts.

Price 35/-

Replacement Plunger Tip, 4/10.

New Zealand Distributors: H. W. Clarke,
Auckland and Wellington.

... is preferred
for the more difficult soldering
in radio, television and electronic equipment

1. Scope's small size ensures easier access to job.
2. Scope's lightness (3½ozs) aids the operator for delicate soldering.
3. Scope's small tip does not radiate heat in all directions, nor does the heat travel up the barrel.
4. Scope heats up in 6 SECONDS.
5. Scope soldering is amazingly fast. Heat is generated directly at the back of the small tip which is used purely as a means of conveying the heat to the work.
6. Scope is absolutely safe. Operates from AC Mains through National Scope Transformer (optionally supplied) or from a car battery.

Retail Price 50/-

National Scope Transformer, 49/7, fully approved under Prescribed Articles of the Electricity Authority Approval No. N/156

To fully appreciate this amazingly versatile soldering iron visit your supplier and test Scope for yourself.

Australian & Overseas Agents:

WM. J. McLELLAN & CO. PTY. LTD.

126 Sydney St. (Just North of King St.) Sydney, N.S.W.
MANUFACTURED BY SCOPE LABORATORIES, MELBOURNE, VICTORIA

FLEXIBLE FOIL MAKES MAGNETIC SHIELDING EASY

Modern ideas of miniaturisation have brought many specialised problems with them, not the least of which is the difficulty of shielding small parts which must be packed into a small space. This newly developed shielding tape suggests a promising answer to many such difficulties.

NEW dead-soft magnetic shielding foils can be cut to any required size or shape with ordinary scissors and trapped tightly around a relay, vacuum tube or other component, to provide low-level shielding over a wide frequency range. Two wrappings provide ample shielding without leakage at joints.

Miniaturisation is facilitated because the thin foil does not appreciably increase the bulk of the component. A tube wrapped in the foil will still fit in a standard shield even with the 0.007-in. foil, which is the thickest now made. The other standard thickness is 0.004 in. The material is available from the Magnetic Shield Division of Perfection Mica Co., as Metac and Co-Metac foils in rolls of various widths and lengths. It wraps tightly like a tape and does not spring back because annealing leaves it soft. Attenuation ranges from 8 to 1 at 60 cps to 1,200 to 1 at 250 Mc.

The foils can be advantageously used in a host of laboratory, electronic, electrical, airborne and shielded room applications. These include all types of experimental shielding for laboratory testing, transformer chokes, cable wrapping, lining the inside of vibrator and shield cans. Vacuum-tube shielding, and



Wrapping relay with flexible magnetic shielding foil, thin enough to fit inside regular housing of relay.

lining the inside of wood or aluminium cabinets for ham or hi-fi uses.

An unusual application is using the foil as wallpaper to shield an entire room. The material can be applied by any carpenter, paper hanger or electronic technician in a matter of hours, using only scissors, hammer and small nails. With wide overlap construction, no welding, soldering or brazing is required. If desired, a pleasing finish may be added by painting. The foil wallpaper eliminates the expense and problems of bringing an unwieldy conventional shielded room into a hospital, laboratory or other location where space and access are limited.

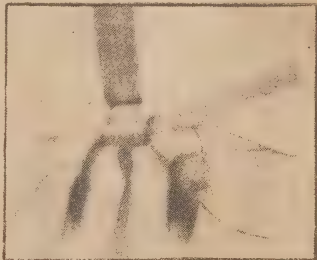
Hospital bed enclosure shields as well as electro-encephalographic rooms may be constructed by first placing foil layers between flooring materials or directly beneath the entire bed. The rest of the shield should be fabricated with a hinged end or side so it can be slid around the bed when needed. Shielding is not affected by the outer or inner materials. The inner material should then be padded for soundproofing or patient protection and the outer layer finished in a material that harmonises with the appearance of other hospital equipment. Air conditioning or air replacement may be provided if the enclosure is to be used for long periods of time.

The flexibility is a valuable factor in providing greater hi-fi fidelity. Applications here include lining high impedance input transformer cans, spiral wrapping around input lead from pickup head to preamplifier, wrapping pickup arm and head liner, use as disc between friction plate and turntable, use as sub-panel under turntable between amplifier and pickup head, use as tube wrappers inside normal tube shields at input stages, and separating tuners, amplifiers and pre-amplifiers.

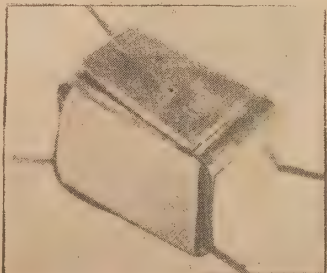
End of wrapping can be anchored with small piece of Scotch tape. Shield can be grounded conventionally, but this is usually not necessary.



First step in shielding miniature audio transformer. Strip of foil is cut from sheet with ordinary scissors and folded at angle as shown.



Wrapping with single strip of foil in manner shown, to get two layers on each side leaves no gaps for flux leakage.



Method of wrapping vacuum tube in Co-Metac foil to prevent hum pickup.



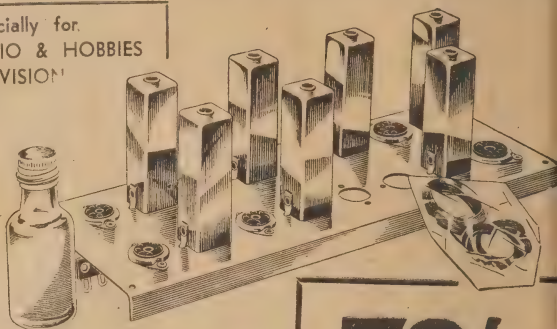
Wrapped tube slips easily into standard aluminium shield can, since foil is thin and dead-soft.



TV COMPONENTS

from **MAGRATHS!**
MADE & TESTED FOR AUSTRALIAN CONDITIONS

Especially for.
RADIO & HOBBIES
TELEVISION
SET!



HERE ARE TWO VITAL COMPONENTS

FOR MAKING THE IDEAL
TELEVISION RECEIVER!

● AEGIS UNWIRED SOUND AND VIDEO STRIP

K7TV: designed primarily for the home constructor. Full winding details are supplied with each kit. Comprises:—punched and plated chassis, 7 unwound I.F. transformer assemblies complete and attached, 4 x 9-pin valve sockets, 3 x 7-pin valve sockets, 6 terminal strips all attached, 4ft. 24-gauge wire, 24ft. 28-gauge wire, 50ft. 30-gauge wire, 22ft. 36-gauge wire, 1 bottle Q-kote B.

78'9

Including sales tax

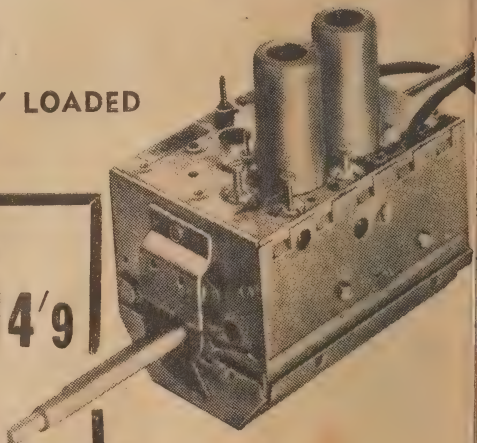
NOW AVAILABLE!

"CYLDON" TURRET TUNERS FULLY LOADED
FOR 10 AUSTRALIAN CHANNELS!

Completely
assembled with
Valves. FULLY
TESTED and ready
for immediate work.

£12'14'9

INCLUDING
SALES TAX



SEE OUR
FULL RANGE
OF OTHER
TELEVISION
COMPONENTS
including
ALL METAL WARE!

MAGRATHS FRIENDLY HELP IS ALWAYS AVAILABLE
Allow us to advise you on the choice of the most suitable TV components for your purpose
and help with your TV problems.

J. H. MAGRATH & CO. PTY. LTD.
208 LT. LONSDALE ST., MELB., VIC. FB3731

NEWS AND VIEWS OF THE MONTH

Varming The North

RUSSIAN engineer Arkady Marking has a plan to use waters of the Pacific Ocean to relieve severe northern climates.

He proposes building a dam fitted with atomic-powered pumps across the Isthmus Straits.

Warm water from the Pacific would be propelled to the north, warming the atmosphere in Siberia and Northern America.

Similarly, he proposed bringing warm Atlantic waters through the Arctic area to the Pacific to cancel out the Greenland, Labrador and cold oceanic streams. "Even in such places as New York, London, Berlin, Stockholm and Vladivostok, temperatures would rise by 10 to 14 degrees Fahrenheit," Mr. Marking said.

★ ★ ★

Quick-loading Aircraft

LOCKHEED has developed a push-button method of moving 35,000lb cargo into or out of a Hercules plane in 40 seconds.

The Australian Air Force is re-equipping its Transport Command with Hercules.

The company claims that its mechanical loading system will save 40 per cent manpower and 90 per cent in idle ground time.

It said that four-engine transports similar to the Hercules could be loaded in about 15 minutes by the push-button machine, compared with two to four hours or even more by present methods.

The system called for pre-packing pallets or "pouches" of cargo, each weighing up to 7,000lb.

The pallets were moved on their own rollers from warehouse to truck to plane ramp.

★ ★ ★

Belgium Has Street SOS

A NATIONWIDE network of nearly 3,000 roadside SOS telephones has been completed in Belgium.

In case of accident or breakdown, a motorist can call for help from the telephone boxes, which are placed at 2½-mile intervals along the road.

One box is placed on each side of the road to prevent possible accidents by people running across the line of traffic to reach the phone.

Instructions are printed in French, Flemish, English and German, together with the telephone number of police and two nearby garages.

The cost of breakdown calls is recovered by the garage which answers the call. No coins are necessary.

★ ★ ★

Electronic Fishing

JAPANESE fishermen are making huge catches with the help of a radio "fish-finder."

This equipment is claimed to be so effective that it can spot a single fish swimming 600ft below the surface.

It is the latest electronic gadget to help Japan's fishing fleets feed a nation of 90 million mouths.

Ordinary ship's radio, radar, long-

range navigation, direction-finding gear, depth-finding sonar, were, already making their task easier.

But the "fish-finder" is reported to be having startling results.

Developed by scientists of the Ministry of Agriculture and Fisheries' floating laboratory after years of research, it operates on the principles of echosounding.

While the echo-sounder, now in use all over the world, records just the depth of the ocean by reflected sound-waves, the fish-finder is capable of much more delicate perception.

It can locate objects swimming 300ft to 600ft beneath the surface, and can even spot things resting on the seabed.

A spokesman for the Ministry's scientific research laboratory said ultrasound waves ranging as high as 200,000 kilocycles are used to locate fish.

★ ★ ★

Atom power for Norway

WHEN the new Norwegian industrial atomic reactor at Halden, in East Norway, South of Oslo, opens at the end of this year, it will supply local pulp factories with 10,000 tons of steam daily.

The annual consumption of steam for Norwegian industry is estimated at 10-million tons.

Norway will buy 16 tons of heavy water in the United States and eight tons of natural uranium fuel elements in Britain for her civilian atomic research.

The total cost is about £500,000.

POPULAR SCIENCE QUIZ

Q—Is it true that a camel's hump contains water?

A—No, this is not true. It was once thought to be so, probably because of the camel's ability to go for long periods without water, and its apparent indifference to heat which would kill a man if experienced over a similar period.

The camel's hump is mostly fat and forms an emergency food supply. It represents the layer of fat which in most animals is distributed over the surface of the body. The camel has a peculiarity not yet explained of losing water only from the tissues under conditions of heat, and not from the blood supply.

It can withstand a loss of water almost one quarter of its own weight—at least twice as much as a man—and a few minutes' drinking is sufficient to replace it. Moreover, the camel does not sweat easily, and this assists further in avoiding loss of water.

It is simply a matter of the camel being physically built to

withstand desert heats better than most animals.

Q—What is the cause of migraine?

A—Many of the physical effects of emotional upsets are not completely understood, but migraine is considered to come into this category. Other people suffer from stomach upsets, high blood pressure, and skin troubles from these causes. The factors which determine whether any of these reactions will be found in any particular person are likewise obscure, but they are very real for all that.

It has been suggested that migraines and headaches are caused as after-effects of the extra-muscular tone which occurs as a protective measure to counter some anticipated or real stress. Emotions such as fear and rage are very commonly the triggers which commence a train of such reactions. The muscular reaction in turn affects the blood supply, and sometimes vice versa, with the result

that headaches and other ailments make their appearance. In all cases, the better the physical condition of the body at a given time, the more easily it can cope with emergencies.

Q—Have men ever made precious stones?

A—It is a moot point as to whether simulated stones remain precious or not. However, many natural crystalline forms have been duplicated artificially, although most of them are only found in nature.

Recently an American firm claimed to have made artificial diamonds, but the process still remains a secret. Diamonds are a form of crystallised carbon, and enormous pressures and temperatures within the earth are needed to produce them. The firm claims to have duplicated these conditions involving pressures up to 1,500,000 pounds per square inch and temperatures of over 5,000 degrees F. The diamonds are intended for industrial use.

This is the WORLD'S FINEST MAGNETIC RECORDING TAPE

EMITAPE

As used by the leading Broadcasting
Organisations and for the recordings by:

"HIS MASTER'S VOICE,"
COLUMBIA AND
PARLOPHONE

EMITAPE "88"

General-purpose tape available on spool sizes from
3" to 7" diameter.

EMITAPE "99"

Long play—thin-based tape, giving 50% increased recording
time on same spool range.



EMITAPE uses P.V.C. (polyvinyl-chloride) high-tensile film base—the film base which has strength
plus stability under varying temperature and humidity conditions.

EMITAPE has a specially developed magnetic oxide coating of high sensitivity with an electrical
specification designed to achieve the maximum performance from all tape recorders, all speeds, single
or twin track.

Engineering Sales Division

E.M.I. (AUSTRALIA) LIMITED, 301 Castlereagh Street, Sydney, N.S.W.
E.M.I. (AUSTRALIA) LIMITED, 167 Flinders Lane, Melbourne, Victoria.
E.M.I. (AUSTRALIA) LIMITED, 265 Rundle Street, Adelaide, S.A.
A. E. HARROLD PTY. LTD., 123 Charlotte Street, Brisbane, Qld.
MAINLINE DISTRIBUTORS PTY. LTD., 73 King Street, Perth, W.A.



T.R.15.FP

CSIRO Yarn Tester

C.S.I.R.O. scientists have designed an electronic machine to test yarns for the textile industry.

They took two years to perfect the machine at the Wool Textile Research Laboratory, Ryde.

The laboratory head (Mr V. Burgmann) said the machine would help manufacturers produce improved cloth with a better appearance.

"We think our equipment is cheaper, more reliable and accurate than existing methods," he said.

The machine measures the vibrations of yarns from sheerest nylon to thickest blanket wool to determine the evenness of manufacture.

TV Aerial Fees

MUNICIPAL councils in Victoria have lost the battle of the TV aerial.

Amendments to the uniform building regulations gazetted recently provide that councils may charge a minimum fee of 10/ for all TV aerials with unsupported lengths of more than 15ft.

The fee will increase by 1/ for every foot above 25ft.

The State building regulations committee agreed to this after investigating councils' claims for a general charge on TV aerials. The decision to restrict fees to tall aerials means that most householders with TV sets in the metropolitan area will not have to pay anything.

Experts told the committee that there was little danger of an ordinary household TV aerial falling and causing damage.

Stereoscopic Television

A STEREOSCOPIC television camera unit specifically designed for use in nuclear research is being supplied by Marconi's to the British Atomic Energy Authority research station at Harwell.

It will be used with special remote manipulating equipment for the handling at a distance of dangerous radio-active materials. Some form of visual aid is necessary for operations of this kind. Ordinary closed-circuit television has been tried, but the absence of perspective in the screened image makes it difficult for the operator to judge the distance of the manipulator's "hands" from the objects to be handled. With the Marconi stereoscopic television, perspective has been restored and the operator sees what appears to be a solid (i.e., three-dimensional) image.

The Marconi stereoscopic camera channel consists of two industrial Vidicon cameras, two control units and two display monitors. The cameras are mounted side by side, with their lines of sight inclined so that they intercept at the "point of interest."

The left-hand camera of the pair (corresponding to the left eye) is connected to one of the monitors, which thus gives a left-eye view of the scene; similarly the right-hand camera and monitor give a right-eye view.

The two monitors are positioned in the display cabinet in such a way that the pictures are superimposed by means of a semi-silvered mirror. A vertically polarised filter covers the face of one screen, while the other is covered by a second filter which is horizontally polarised. If the composite image is viewed through suitably polarised spectacles a stereoscopic effect is obtained.

WANTED

Radio Officers and Traffic Assistants

for the

OVERSEAS TELECOMMUNICATIONS COMMISSION (AUSTRALIA)

The Overseas Telecommunications Commission operates Australia's overseas communications services through two main telegraph offices, five cable stations and six international radio stations, in addition to the Coastal Radio Service through 23 stations around the coast of Australia and in Papua/New Guinea.

TRAFFIC ASSISTANTS

Vacancies exist for young men up to 19 years of age with the Intermediate Certificate as Traffic Assistants in the Commission's telecommunications centre at Sydney.

Initial duties include recording, sorting and distribution of telegraphic traffic at a commencing salary of £364 per annum for those under 18, rising with age and experience to £822 per annum while earlier higher salary ranges may be attained by qualifying as Telegraphist, Radio Officer or Radio Technician. These are permanent positions with free or assisted training facilities and Commonwealth Superannuation.

RADIO OFFICERS

Vacancies exist in the Commission's Coastal Radio Service for holders of a First or Second Class Commercial Operators' Certificate of Proficiency in Radio telegraphy and Radio-telephony who are capable touch typists. Successful applicants who are medically fit have the opportunity to serve at stations situated in all capital cities and at other places around the coast of Australia and in Papua/New Guinea.

The salary range is £912-£1062 for holders of First-Class Ticket or £882-£1062 for persons with Second-Class Ticket. Shift work is involved for which extra payments are made, while other allowances are payable at tropical and remote stations up to a maximum of £320 per annum for a married officer stationed in Papua/New Guinea or at Darwin.

Hours of duty are 36 per week while annual leave accrues at the rate of from 15 days per annum at southern locations up to a maximum of 30 days per annum at certain northern stations.

Furnished staff cottages at a moderate rental are available at most non-metropolitan locations. Early permanent appointment which carries right of entry into the Commonwealth Superannuation Fund is available.

APPLY TO:

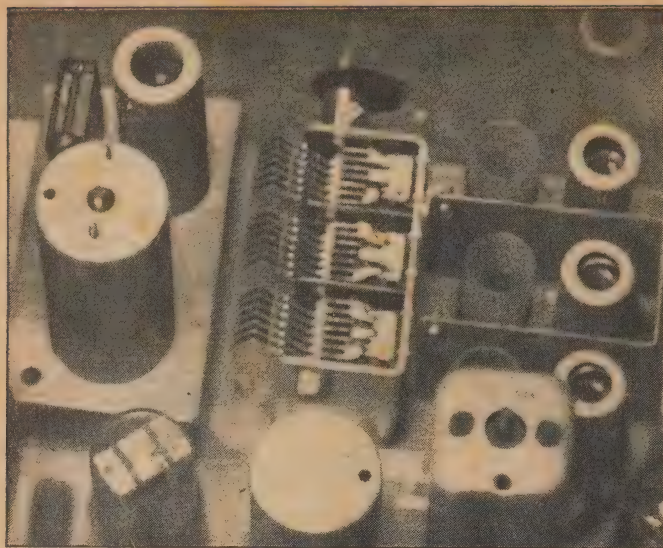
The Chief Administrative Officer,

Overseas Telecommunications Commission (Australia),

Box 7000, G.P.O., Sydney.

or ring B0544, extension 259, and arrange for an interview.





We found a few square inches alongside the tuner unit for the second converter stage in the test receiver. Input and output connections are made by low capacitance coaxial cable.

A Double Change Amateur Tuner

A sensitive, selective receiver free of spurious responses is the aim of every serious amateur. Factory built receivers with the required specifications are not obtainable easily here, as in other countries, so that most amateurs needing a good receiver are faced with building their own. This article discusses some of the problems and shows how a double change superhet design permits a very satisfactory solution.

WHILE we refer particularly to the bandspeed tuning unit described in the January issue, the idea of using a double superhet is perfectly general and could well be applied to any superhet receiver you already have which is satisfactory in all but its ability to reject image signals.

Most of our amateur readers will be familiar with the problem of image rejection in superhet receivers but a brief review may not be out of place.

Take the case of a superhet operating on the popular 14 Mc band and using the normal 455 Kc IF channel. The local oscillator in the receiver may be tuned to 14,455 Kc in which case the incoming 14 Mc signal will beat with it to produce a 455 Kc signal at the output of the mixer valve.

At the same time, if a signal with

frequency 14,910 Mc (14,455 plus 455 Mc) is applied to the mixer stage it will also produce a signal at 455 Kc by the same heterodyne process.

The only factor which prevents the receiver responding to signals at 14,910 is the ability of the tuned circuits preceding the mixer to accept the 14 Mc signal and reject the 14,910 Mc signal.

Obviously the closer the signal and the image frequencies, the more difficult

it becomes to select one from the other. For a given receiver, if we wish to improve the response to the required signal in relation to the image signal, there are two possible courses of action.

The first is to improve the selectivity of the circuits preceding the mixer stage. This can be done either by increasing the efficiency of the circuits or by increasing their number. There are practical limits beyond which it is difficult to increase the Q of the input tuned circuit and increasing their number brings up the cost sharply due to the need for keeping them tuned in step as the receiver is tuned across the frequency range.

Designers of many highly rated communication receivers have adopted this solution, however. Many use three high Q tuned circuits preceding the mixer and are able to give good image rejection at frequencies up to 30 Mc with the ordinary 455 Kc IF channel. The oscillator section also has to be tuned, of course, and, therefore, a 4 gang tuning capacitor is required.

ONE OR TWO STAGES?

One of the factors contributing to influence designers to adopt this solution in the past was that the additional R.F. amplifier stages between the tuned circuits helped to build the signal level up to the point where noise generated by the mixer was no longer significant by comparison.

Nowadays, there are plenty of low noise, high gm valves available and the gain needed to mask mixer noise can be obtained in a single stage. At frequencies up to 30 Mc at least, the argument in favour of a number of R.F. circuits is not quite so strong for this reason.

The second of the possible solutions to the image problem is to increase the intermediate frequency. The greater the IF the further away the image and the greater the attenuation of the image by a given tuned circuit. With an IF of

10 Mc or higher, there is no difficulty in obtaining a good signal to image ratio at frequencies up to 30 Mc given that two signal frequency tuned circuits normally associated with a mixer and single RF amplifier stage.

The difficulty here is that it is impractical to design an IF channel of 2 Mc or higher with sufficient selectivity to eliminate unwanted signals in channels close to the desired signal.

Therefore, the intermediate frequency chosen for a superhet receiver is a compromise between the requirements of image rejection and adjacent channel selectivity. The value of 455 Kc has a really special significance except that it has been evolved over the years as found capable of meeting the requirements of most broadcast and many shortwave receivers. It has received

by Maurice
Findlay

Circuit is of the tuner described in the January issue with the addition of a second converter stage. Note that a paddar capacitor is required for the 7 to 11 Mc range.

official recognition and transmitters are kept clear of the frequency to minimise the possibility of interference due to strong signals forcing their way directly into the IF channel.

Plenty of components are available for 455 Kc IF amplifiers: filter crystals, coupling transformers with varying degrees of selectivity and so on. Therefore, there is every reason not to deviate from the accepted standard unless there is a good reason for so doing.

In our case, the reason is that it is impractical to design input circuits for the 14, 21 and 28 Mc amateur bands capable of rejecting the signals of the many powerful commercial stations which appear at image frequency.

BEST SYSTEM

The advantages of both the high IF in rejecting images and the low IF in the matter of selectivity can be retained by installing a second mixer stage which converts signals at the first IF to a second lower IF. Such a receiver is known as a double superhet.

As with most such schemes, the double superhet is not without its disadvantages. The major drawback is the possibility of spurious responses due to the presence of the oscillator stage necessary for the second frequency converter stage. The frequency of this oscillator stage has to be very carefully chosen if difficulties are to be avoided. If, for example, it were made 2 Mc. harmonics of the oscillator would produce spurious responses in the receiver at intervals of 2 Mc throughout the spectrum and obviously interfere with reception at desired frequencies. In our case it is necessary to cover the frequency range from 7 to 11 Mc. It is not hard to see that the frequency of the second oscillator must be higher than 5.5 Mc if a harmonic within this range is to be avoided.

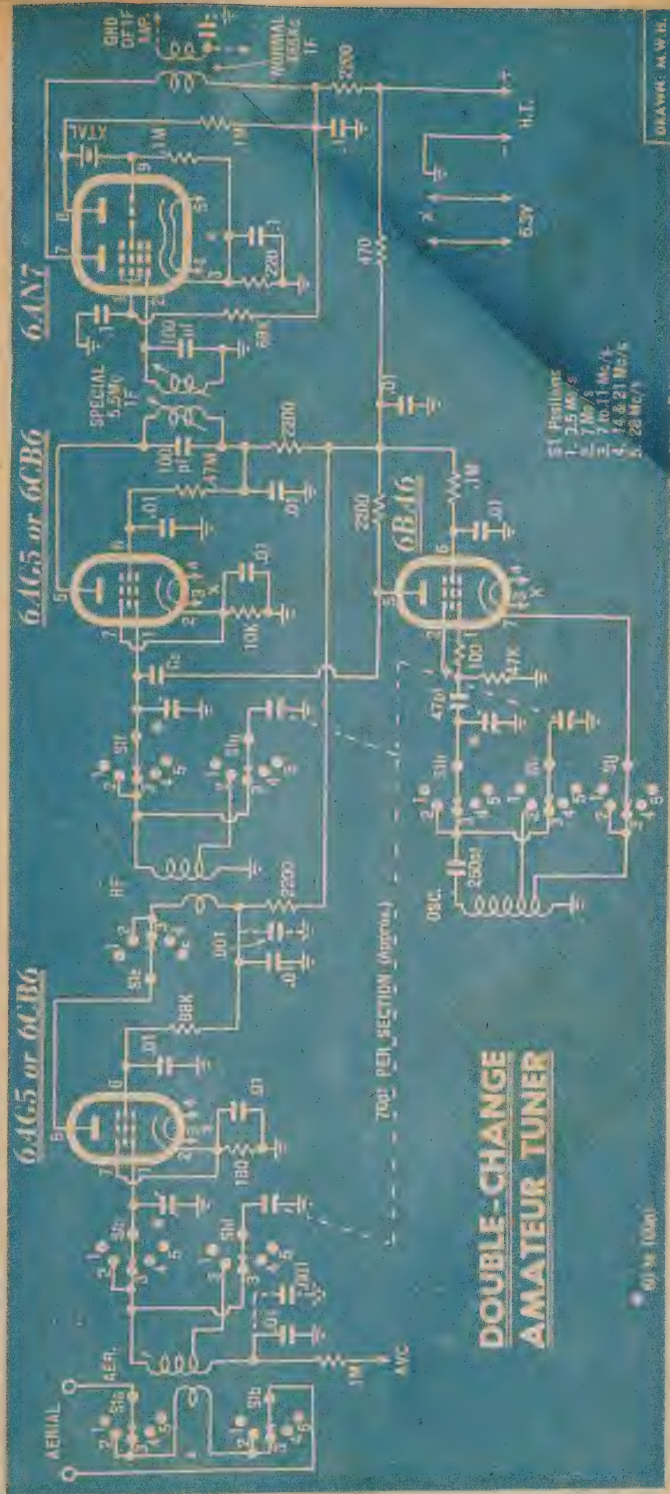
You may at this stage suggest that the second oscillator be shielded confining its energy inside a metal case when the frequency of its fundamental and harmonics would not be so important. While this is possible it is hardly practical since techniques similar to those used in a full sized laboratory signal generator are needed to reduce the amplitude to a level below the noise.

ELABORATE SHIELD

We have not actually conducted any experiments but it may be necessary to install a double shield with filters in all incoming leads including the input at the first IF and the output at the lower second IF.

It is better to avoid this altogether by carefully choosing the frequency of the second oscillator. A few minutes with a slide rule will make the requirements clear and a diagram in this article shows the results.

For no direct harmonics to appear in the band, the frequency of the second oscillator must be between 5.5 and 5.6 Mc. or between 6 and 6.75 Mc. if



The World-famous GRAMPIAN 5/10 BU Power Amplifier

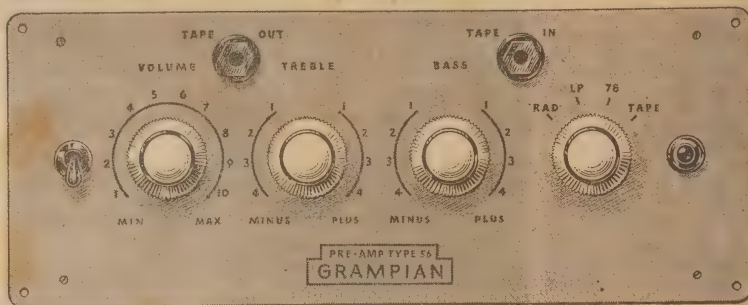
Now available with

10mV

High Sensitivity Pre-Amplifier and Control Unit Type 56

A Combination which offers

Unsurpassable Value at 56 Gns.!



The Grampian Amplifier Type 5-10 BU:

A High Quality Amplifier, based on the modified Mullard design. The Circuit is a 3-stage one, with 20.5 db of negative feedback, with an ultra linear, distributed load outward stage employing 2 pentodes in push-pull. The large-sized mains transformer provides ample power for a tuner unit.

Specifications:

Power output, rated: 10 watts

Total Harmonic Distortion: Less than 0.4% at 400 c/s.
Less than 0.2% at 2,000 c/s.

Hum and Noise: -73 db relative to 10 watts

Frequency Response: Plus Minus 0.5 db 10 c/s to 20,000 c/s.

Output Impedance: 15 ohms or 4 ohms.

Supply available to radio unit: H.T. 250 volts
40 m. amps. Heaters 6.3 volts 3 amps

Pre-Amplifier & Control Unit Type 56:

The combined Pre-amplifier and Control Unit is for use with any type of Pickup including low-level variable-reluctance types. A feedback circuit provides correct compensation for LP and 78 r.p.m. records and also enables the unit to be used with inputs from a radio tuner or tape recorder.

Specifications:

Pickup input: Impedance, 200,000 ohms; sensitivity, 10 mV.

Radio input: Impedance, 100,000 ohms; sensitivity, 100 mV.

Tape input: Impedance, 100,000 ohms; sensitivity, 50 mV.

Tone controls: Bass, +10 db to -8db at 40 c/s; treble, +10 db to -10 db at 10 kc/s.

Power required: 250v 2 m.a. 6.3v 0.5 A.
Valves: 2 EF86.

SUPPLIES FROM PROGRESSIVE RADIO RETAILERS THROUGHOUT THE COMMONWEALTH

WHOLESALE ENQUIRIES TO AUSTRALIAN NATIONAL DISTRIBUTORS:

Simon Gray Pty Ltd.

28 ELIZABETH STREET, MELBOURNE C.1. Telephones: MF8211, MF8166

Chassis is 4in. x 2in. x 1in. and could be made much smaller if required. It mounts converter valve, crystal and the special 5.5 Mc IF transformer to the right.

You are interested in the 27 Mc. amateur band. If you are not interested in the 27 Mc. band, it would be in order to use any frequency between 6 and 7 Mc. Bear in mind that if the frequency is exactly 7 Mc., a harmonic will appear on the band edges.

Before taking this matter any further, it may be as well to consider how the frequency of the second oscillator can be controlled.

It would be possible to set up another oscillator generally similar to the first high frequency oscillator. The frequency could then be varied to suit requirements by varying either the capacitor or the inductor of the tuned circuit.

While a variable oscillator frequency may be desirable to allow a frequency to be chosen which does not result in regular spurious responses, we are inclined to favour the idea of using a crystal.

THE EASIEST WAY

A simple crystal oscillator circuit requires no adjustment and the frequency is definitely established. Furthermore, since the frequency is of the order of 5 Mc. there is always the possibility of drift which could easily be additive with any drift in the first high frequency oscillator and make the overall receiver just that much less stable. It must not be implied that the stability of a self-controlled oscillator is necessarily poor, but if it is possible to obtain a very high order of stability with an inexpensive crystal plus simple circuitry, it is very hard to go past it.

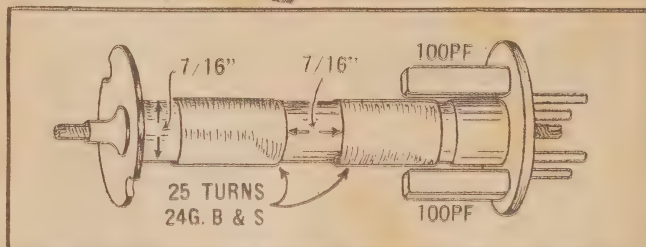
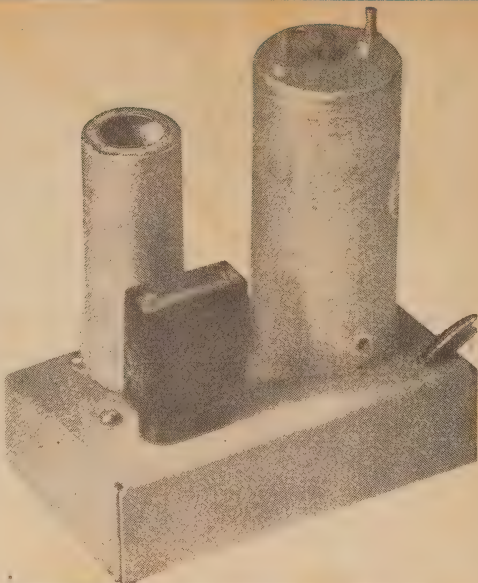
Large numbers of crystals were made for military purposes during the war and many of these have found their way into the hands of disposals dealers. Amateurs were quick to buy up crystals with harmonics falling in the amateur bands but there are plenty of others with frequencies between about 5 Mc. and 7 Mc. available at small cost.

Provided the crystal has not been interfered with, you can usually rely on its frequency being within 1 Kc. or so of the marked figure in practically any oscillator circuit. Bearing in mind the foregoing about frequency requirements, the most suitable from our own stock of crystals appeared to be one marked "6092" and it was this crystal that we actually used in the tests. Subsequently a 6053 Kc. crystal was tried with very similar results apart from a small amount of realignment.

FIRST IF

Assuming a standard 455 Kc. second IF, the frequency of the first IF will be determined by the crystal. The actual first IF used in our case is 5.6 Mc. approx. and the first IF transformer is exactly the same as used in a double change superhet described some years ago. With no modifications to the number of turns and spacing of the windings it will be possible to vary the frequency between about 5 and 6 Mc with the variable slugs. Should you be using a crystal with frequency up near 7 Mc you

The addition of this simple converter unit to your receiver could mean the elimination of interference due to images of the higher frequency amateur bands. Some modifications to the oscillator coils are necessary in order to provide tracking with the higher IF.



Winding details for the special 5.5 Mc IF transformer which is made from an old 455 Kc transformer with the windings stripped off. It is aligned by means of the normal slugs.

can easily use a few less turns than specified.

If any choice exists, we suggest that you choose a crystal on as low a frequency as possible. Our reason for this comment is that the 7 Mc coils are called upon to reject signals which may find their way into the receiver through the first IF channel. It is fairly clear that the further from 7 Mc the first IF the greater the attenuation provided by the 7 Mc coils.

POINTS TO WATCH

In our case the spurious response occurs at 5.6 Mc, but the input signal has to be very strong, indeed, since with the receiver tuned to the low frequency end of the band, the receiver input circuits are 1.5 Mc from the IF channel.

This spurious response is far less serious than the usual image response since it involves only the one frequency and not a whole range of frequencies. If you happen to choose a frequency which allows a strong signal to get directly into the IF you can either change the frequency slightly or place a fixed rejector circuit in the input of the receiver.

There is another possible source of

spurious responses in a double superhet which we should mention for the sake of the record. Harmonics of the crystal oscillator combining with the fundamentals or harmonics of the variable, high frequency oscillator or vice versa, may produce signals within the tuning band.

It would be a prohibitive task to analyse all the possible combinations, and all we can say is that we have experienced no trouble in this regard. Care has been taken to run both the crystal and the tunable oscillators at as low a level as practical and any combinations within the range are apparently at a very low level because we were not able to observe them.

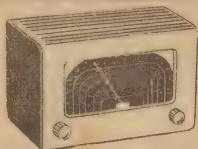
TROUBLE UNLIKELY

It was quite impossible for us to try all the crystal frequencies, but if spurious responses due to combinations of harmonics did exist we suggest that some form of simple shielding around the crystal oscillator would effect a cure.

Apparently this trouble is not generally present because a number of current overseas double superhet communicating receivers using crystal second oscillators do not make any special shielding provisions. The crystal, chosen so that its harmonics do not appear within the required bands, is mounted directly on the

MASTER ELECTRICS PTY. LTD.

A WHOLLY OWNED
SUBSIDIARY OF
MOTOR SPARES LTD.



ONE VALVE KIT SETS

For the Learner

Although this little set is quickly and simply built it looks like a factory job. The wooden cabinet is covered with burgundy leatherette and the dial has all Australian stations marked in different colours. Parts are mounted on a wooden baseboard and anyone can build it if they can use a soldering iron. Circuit diagrams, wire, solder, etc. supplied. Price of complete kit of parts, valves, headphones and batteries. Normal price, £8/5/0.

OUR PRICE £5/19/6



CATHODE RAY TUBES AND RADIO VALVES

Type VCR 138 3 1/2 inch diameter cathode ray tube. Ideal for oscilloscopes etc. Characteristics:—

- Filament Volts 4.
- Filament Current, 1 amp.
- Anode 2 200 volts.
- Grid 1-50 volts.
- X Plate sensitivity .14
- Y Plate sensitivity .33.
- Anode 3-1200 volts.
- Electro-static deflection.
- Colour green.

Socket connections can be supplied to each purchaser.

Price, 25/- each.

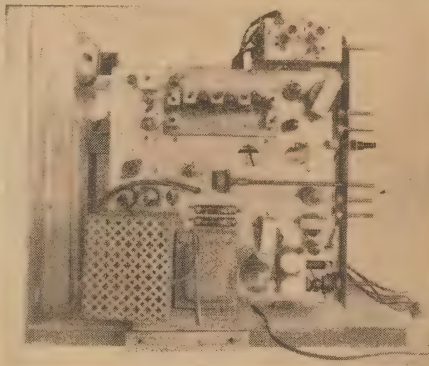
Type 902 2 1/2 inch Cathode Ray Tubes, ideal for instruments etc. Brand new and boxed. Well-known make, 47/- each. Type 815 Push-pull RF Beam Power Amplifier. Used as class AB2 A.F. Power amplifier and modulator. Max. output 75 watts. Class C Telephony, max. output 60 volts. Filament Volts 12.6 or 6.3. An excellent valve for H.F. work. Brand new and boxed.

OUR PRICE 35/- each

SPECIAL NOTICE

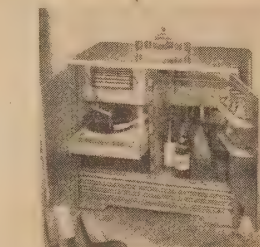
All parcels sent Registered Post unless otherwise stated. Postage or Freight must be included with order.

WIZARD TELEVISION KIT SET



This kit has proved itself to be a good performer which will give an excellent picture and good quality sound under any normal operating condition. When properly aligned it will work quite as well as a commercially built TV receiver.

The circuit uses 18 valves plus 2 diodes plus a 17HP4B or 21 ALP4A Picture Tube. will receive all ten channels and uses well-known and reliable components throughout. To all purchasers of a complete Kit of Components we make this offer. We will align your set for 25/- hour labour charge. Please write for new low price on this kit.



RADIOGRAM CABINETS

We have a wide assortment of radio-gram and cocktailgram cabinets available, some secondhand, others new.

Priced from £5 to £60

Please write for information and illustrations etc.

SPECIALS

- 1. ITX 9108 Chokes, 100ohm centre tapped 80 ma new. Worth 45/- . Our Price 13/9.
- 2. TZ162 Chokes, 280 ohms DC Resistance 60 ma New. Worth 17/6. Our price 7/6 ea.
- 3. 100 ma Power Chokes, Brand new and boxed. A really good filter choke. Worth 45/- . Our price 15/-.
- 4. Germanium Diodes, English make, brand new and perfect. Ideal for use as crystal detectors, rectifiers etc. Only 4/11 ea.
- 5. 250 ohm Rheostat 25 watt Mica and porcelain insulation I.R.C. Price only 4/6 ea.
- 6. PM 957 Ferrocart Vibrators 12 volt synchronous, split reed, with octal base. Socket connection diagrams available. Price only 10/- each.
- 7. 400 Volt amp. Auto Transformers, 230 to 110 volts AC at 50 C.P.S. Ideal for adapting 110 volt equipment to operate off 230 volt AC mains. Made in U.S.A. and are brand new and boxed. Worth £21/10/0. Our price £5 each.

- 8. Ceramic Spacers with 1.8inch Whitworth thread O.D. 1/2inch 1/2 inch. Price only 2d each or 1/6 doz.
- 9. High Impedance Headphones ideal for crystal sets, valve sets and most applications. New only 22/6 pr.
- 10. Transmitting coils consisting of 6 turns spacewound 3/4 inch diameter of 10 gauge B & S silvered copper wire only 1/- each.
- 11. Red Diamond Crystal Detectors, semi fixed type. Brand new and boxed. Worth 10/7. Sacrificed for 3/6 each.
- 12. Red Diamond Refills for above worth 5/4. Our price, 1/6 each.
- 13. Few only interference suppression condensers for 240 volt AC Test voltages 2250 DC Capacity 1.5, 1 x .01. Worth 17/4. Our price, 3/- each.
- 14. Transistors RF type suitable for oscillators, frequency changers and I.F. amplifier up to 8 MC/S. English make similar to OC.44 and OC.45. Price only 45/- each.
- 15. Transistors A.F. type suitable for A.F. amplifiers and output. English make, price only 25/- each.
- 16. We have just received stocks of the following condensers, all are brand new and perfect and made by well-known makers.

Capacity	Wkg.	Voltage	Type	Price
.003		3000	Mica	2/6
.005		400	Mica	1/-
.01		1000	Mica	1/6
.01		2000	Mica	2/6
.01 + .005 + .001		600	Block	1/6
.0015		2000	Mica	2/6
.01 + .01		600	Block	1/6
.025		1000	Mica	2/-
.025		2000	Mica	2/9
.05 + .05		1500	Block	1/9
.1		4000	Block	2/-
.2		400	Block	3/3
2		2000	Block	6/-
4		750	Block	6/6
5		400	Block	4/-
3 + 5		110AC, 400DC	Block	7/9

EL50 POWER OUTPUT PENTODE

6.3 volts filament with P type base, two of these valves in class B will give 80 watts output. This is also an excellent single end tube which will give in class A about 8 watts output and high gain. Well worth 30/-.

Our Price Only 7/6

954, Det. Amp. Pentode 6.3 volts filament, 5/9 each.

547 ELIZABETH STREET, MELBOURNE — Phone FY0271
Branches throughout Victoria and Riverina

in chassis along with other components. At this stage, we can consider the translation of the foregoing ideas into a practical double conversion receiver. Our plans were carried out with the band-pass tuning unit described in the January issue but there will be plenty of others with other receivers they would like to modify.

The original version of the converter was built on a chassis about 4in by 1in and this chassis mounted above the main chassis of the receiver. If you are short of space, it could be made a good deal smaller or even built into the existing chassis.

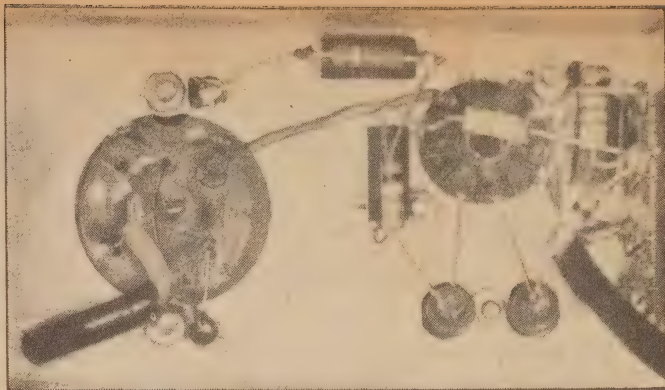
Connection between the special 5.5 Mc transformer and the plate of the mixer valve and also between the plate of the second mixer and the input of the normal IF transformer can be made by means of low capacity shielded lead. Small diameter coaxial cable has a capacity of about 20 pF per foot and if necessary it would be in order to extend both leads up to a foot with cable of this type. Longer extensions are required, it may be necessary to reduce the value of the capacitor inside the transformer.

PLENTY OF FREEDOM

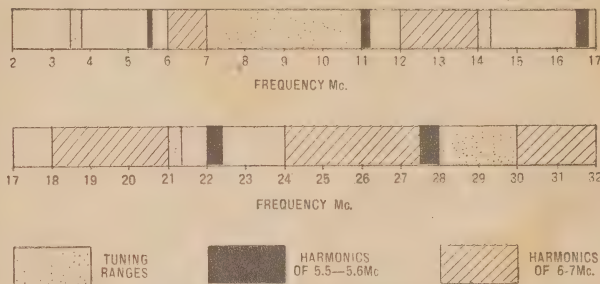
Layout of components on the chassis is not critical, the main thing being to make sure that everything is firmly anchored and that there is plenty of room for all components. A strategically placed tag strip to anchor incoming power supply leads is a good investment from a mechanical point of view.

IF transformers for 5.5 Mc or thereabouts are not normally available commercially. This is of no consequence, since the number of turns involved is small and a standard 455 Kc IF transformer can easily be modified for the purpose.

It should not be too hard to obtain a spare transformer with variable taps and in reasonably good condition. Many standard transformers use 100 capacitors and frequently you can obtain the originals. If not, you could vary the number of turns one way or the other to permit resonance at 5.5 Mc.



The main reason for this photograph is to show how few additional components are required. Physical layout is relatively unimportant.



A study of the above should make it fairly clear why the choice of crystal frequencies for the second converter stage is limited to those between 5.5 and 5.6 Mc and between 6 and 7 Mc.

This transformer is required to have sufficient selectivity to reject the second image. In other words, it must provide high attenuation at 900 Kc approx.

from the resonant frequency. In our case the image was about 60 db down.

The overall image rejection is obviously better than 60 db since the two tuned circuits at the input also discriminate against images at 900 Kc. It will only be in extreme cases that you will hear them and, frankly, we think that you will be able to forget about images at the second converter.

COIL DATA

3.5 Mc BAND (8 mm formers).

Aerial: Pri.—10T 34 B & S enam. Sec.—80T 34 B & S enam. spaced 1/16 from pri.

RF: Pri.—20T 34 B & S enam. Sec.—80T 34 B & S enam. spaced 1/16 from pri.

Oscillator: 33T 28 B & S enam. tapped at 6T and 16T. All coils closewound.

7.0 Mc BAND (8 mm formers) The 7 to 11 Mc range is also covered with this set of coils.

Aerial: Pri.—10T 34 B & S enam. Sec.—38T 28 B & S enam. spaced 1/16 from pri. Tapped at 25T.

RF: Pri.—12T 34 B & S enam. Sec.—38T 28 B & S enam. spaced 1/16in. from pri. Tapped at 25T.

Oscillator: 14T 28 B & S enam. tapped at 4T & 9T. All coils closewound.

14 & 21 Mc Bands (3/4in. formers).

Aerial: Pri.—3T 28 B & S enam. closewound.

Sec.—12T 24 B & S enam. spaced

3/4in. Tapped at 3 1/2T. 1/16in. from pri.

RF: Pri.—6T 28 B & S enam. closewound. Sec.—12T 24 B & S enam. spaced 3/4in. Tapped at 3 1/2T. 1/16in. from pri.

Oscillator: 9T 24 B & S enam. spaced 9/16in. Tapped at 2T.

Secondaries wound on 16 TPI grooved formers.

28 Mc Band (3/4in. formers).

Aerial: Pri.—2T 28 B & S enam. closewound.

Sec.—7T 24 B & S enam. spaced 7/16in. Tapped at 1 1/2T. 1/16 from pri.

RF: Pri.—4T 28 B & S enam. closewound.

Sec.—7T 24 B & S enam. spaced 7/16in. tapped at 1 1/2T 1/16in. from pri.

Oscillator: 6T 24 B & S enam. spaced 1/2in. Tapped at 1T. Secondaries wound on 16 TPI grooved formers.

LOW 2nd IF

However, there will be amateurs who would like to use a second IF lower than 455 Kc in order to achieve even better rejection of adjacent channel signals. There are standard transformers available for 175 Kc, 85 Kc and 50 Kc, the last permitting an extremely narrow bandwidth when aligned all to the one frequency or a very desirable bandpass characteristic with stagger tuning.

The image of the second IF is then only 100 Kc away from the signal, and the discrimination would not be satisfactory. Improved selectivity at 5.5 Mc is the only solution and the best way to achieve this is to add another transformer. While this could be arranged in a back-to-back arrangement with the existing transformer, we do not, in general, recommend the idea because the overall losses may be high enough for noise generated by the second mixer to be significant. A better approach would be to use a stage of amplification at 5.5 Mc.

HOMECRAFTS

RADIO IS OUR BUSINESS

100 CLARENCE ST., SYDNEY. BX 4451



RECORD PLAYING

Collaro 3/554 Record Players.
3-speed studio, "O" Cartridge, £12/15/6

Collaro R.C. 456 Record Changers,
4-speed studio "O" Cartridge, £22/7/6

B.S.R. HF8 Player £13/5/-

B.S.R. UA8 Record Changers, 4
speed £20/10/-

Collaro Transcription Unit with 16in
Arm and PX Head . . . £31/2/6

Dual 1004 4-speed Precision Auto
Changer £32/8/6

TV SET BUILDERS

Cad Plated Chassis and
E.H.T. Supply Covers £3 12 6

Cad Plated IF Strip Chas-
sis £0 19 6

DUAL KNOBS
Channel and Fine Tuner,
Volume and Contrast
Per Set—

Walnut £1 5 6

Tuners — PHILIPS . . £18 5 0

Q Plus IF Strip MK.1 £23 13 2

Q Plus IF Strip MK.2 £28 0 10

Q Plus Coil Locking
Compound £0 7 6

Q Plus VIF Kit No. 1 £6 2 6

MANUALS

Radio Servicing No. 1 7/6

Radio Servicing No. 2 7/6

Fault Finding 7/6

Television Time Base Circuits 7/6

Television Circuit Refinements 7/6

The Oscilloscope Book . . . 7/6

Magnetic Recording Wire and
Tape 7/6

TAPE DECKS COLLARO MK. III

Four Heads. Twin Track
Operation. Switch Mechan-
ism. Pause Control. Tape
Measuring & Calibrating
Device. Two Motors. High
Fidelity. Instantly Reversible.
Constant Tape Tension. Re-
tractable Drive. Fully Mech-
anical. Finish — Cream Poly-
styrene cover plate with
maroon controls. Three
speeds.

£52/19/6

SCOPE

SOLDERING IRONS 6 sec.

Standard £2/10/-

Instrument £2/10/-

Vibroscope £1/15/-

Transformers £2/10/6

Screw type hole cutters

Complete with wrench

7/8" 7 pin £1/9/-

3/4" 9 pin £1/15/-

1 1/8" Octal £2/18/-

16-drawer steel

Cabinets £2/8/6

Q-PLUS CRYSTAL SET



Q Plus Crystal Set complete with
Headphones and Aerial . . £4/19/6

Q Plus Crystal Set only . . £2/13/6

CRYSTAL SET BUILDERS

Single Gang Condensers . . 1 guinea

Q Plus Headphones £2/1/-

Spring Terminals 1/2 ea.

Germanium Diodes

OA70—OA73 6/1 ea.

OA81—OA85 7/1 ea.

Jabel Crystal Coil 8/6 ea.

Aerial Wire (100ft) 14/9 ea.

Insulators 1/- ea.

Boys' Book of Crystal Sets, 5/- ea.

JABEL CRYSTAL SET KIT

Complete with circuit and
plastic cabinet. 59/6 ea.

INVERTERS

Van Ruyten 12TR 12 volt
DC, 240v AC 100 watt Un-
filtered £21/8/-

Van Ruyten 3253FF 32v DC,
240v AC 100 watt fully fil-
tered £31/17/6

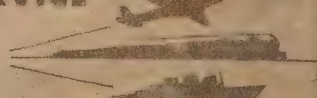
HOMECRAFT'S FAST DESPATCH SERVICE



YOUR ORDER



IS ASSEMBLED BY EXPERTS



AND RUSHED TO YOU

This need not mean that an extra IF stage overall is required since the gain per stage at the lower second IF will most likely be higher. At 50 Kc it is usually possible to obtain more than enough selectivity with two transformers.

The valve used for the second converter stage is not critical and any one of a number of types would perform satisfactorily. Other than the 6AN7, types 6AE8, 6J8-G and 6K8-G come to mind and should perform satisfactorily with minor changes to circuit values.

OSCILLATOR LEVEL

We have chosen the value of the series plate resistor for the crystal oscillator section to keep the amplitude of oscillation reasonably low. It should suit any of the valves mentioned above, but a check on this point would be in order, specially if you are using valves and/or crystals of unknown quality. With the 6AN7, the oscillator grid current should be within the range of 50 to 100 microamperes.

You can take your choice about applying AVC to the second mixer. There are no objections to the idea from the point of view of frequency shift, but if the stage is operated with fixed bias, the additions to the receiver are simplified. Also if you are using a meter in the plate circuit of one of the IF amplifier stages it is likely to be more sensitive if the number of controlled stages is reduced.

We found that we could have a sensitive S meter and at the same time prevent overloading on strong signals by applying AVC to two IF stages and about a quarter of the total AVC voltage to the RF stage. This depends on the receiver and a few experiments may be worth while in order to reach the best arrangement.

The oscillator coils of any receiver in which the second mixer is installed will need modification because of the higher IF. Modifications to the coils or the two lower frequency bands are fairly extensive, but for the higher frequency bands it will be sufficient in many cases to wind off a turn or two and possibly alter the position of the bandspread tap.

COIL DATA

The coil data gives the specifications of the oscillator coils suitable for the tuner described in the January issue.

The main point of interest is that a padder capacitor is required to provide good tracking in the case of the 7 to 11 Mc bands. This is actually the most critical of the ranges to align and there may be some merit in using a few turns less than specified in the coil table and reaching the exact inductance value required by means of variable slugs. These slugs are normally sold with the coil formers when they are used for TV IF strips.

Be careful to keep the stray capacity to ground as low as possible, especially in the case of the 7 to 11 Mc range where it is only just possible to tune the 4 Mc with the double spaced 3-band tuning capacitor. Incidentally, to give more reserve in this regard, we have asked the "Roblan" people to increase the capacitance of the standard double spaced gang available through the grade to 70 pf. It will reduce the bandspread on the other bands slightly, but

(Continued on Page 119)

BOOKS RADIO — TV — ELECTRICAL — ELECTRONICS

MANY NEW TITLES — never before advertised in Australia or New Zealand

4 NEW books on TRANSISTORS !!

- TRANSISTORS. Circuits and Servicing. Reviewed in R. T.V., last August. This book is now available. PRICE 4/3
- TRANSISTOR CIRCUITS FOR THE CONSTRUCTOR. No. 1 and No. 2. These books include details for making a bedside receiver, a wide-range communicator, a match box receiver, a phase shift oscillator, a radio microphone or record player, etc. etc. PRICE (each) 5/3
- TRANSISTORS AND CRYSTAL DIODES: What they are and how to use them. By B. R. Bettridge. AMIRE. A Brand new Edition of this popular book. PRICE 7/6

- TELEVISION. . . Three of our best sellers for 1957 are, once again, in good supply—
- PRACTICAL TV AERIAL MANUAL—by R. Laidlaw. The most comprehensive low-priced book we have ever seen on this subject. Theoretical as well as practical. PRICE 7/6
- SUPPRESSING RADIO AND TV INTERFERENCE—by B. L. Morley. Troubled with spark plug, etc., interference in your car? How to overcome electrical and "static" interference in your radio or TV receiver. PRICE 7/6
- TV FAULTS—by N. Stevens. One of England's leading TV engineers gives trouble tracing procedure, photos of faults as they show on the picture tube. Also includes the circuits of 6 of Britain's leading TV receivers and comments on their servicing. PRICE 7/6

- INEXPENSIVE CAR RADIO—by A. Thiel. In this paper, the author details how he built himself a car radio from disposals parts, and another from brand new parts. PRICE 2/6
- ELECTRONIC NOVELTIES FOR THE CONSTRUCTOR—by E. N. Bradley. A pocket one-valve receiver—a hural buzzer—electronics on the model railway—short wave model control—talk by means of a beam of light—a home TV system. PRICE 7/6
- AMPLIFIERS (Audio Handbook No. 1) by N. H. Crowhurst, AMIEE. This book, whilst low-priced, covers all you will need to know on audio amplifier design, trouble shooting, distortion instability, etc. PRICE 5/3

ELECTRONIC ORGANS!! Interested? If you are contemplating building an organ, then you must have a firm basis of knowledge. This is contained in **THE ELECTRICAL PRODUCTION OF MUSIC**, the latest publication in this field. PRICE £2/6/6

We regret to advise that an **ELECTRONIC ORGAN FOR THE HOME CONSTRUCTOR** is still not available. The publishers now promise stocks at £1 per copy, in April.

THE FOLLOWING BOOKS ARE BEING ADVERTISED FOR THE FIRST TIME IN AUSTRALIA AND NEW ZEALAND.

These are all advanced works in their particular fields, and we shall be pleased to give you individual, full details about any in which you are interested.

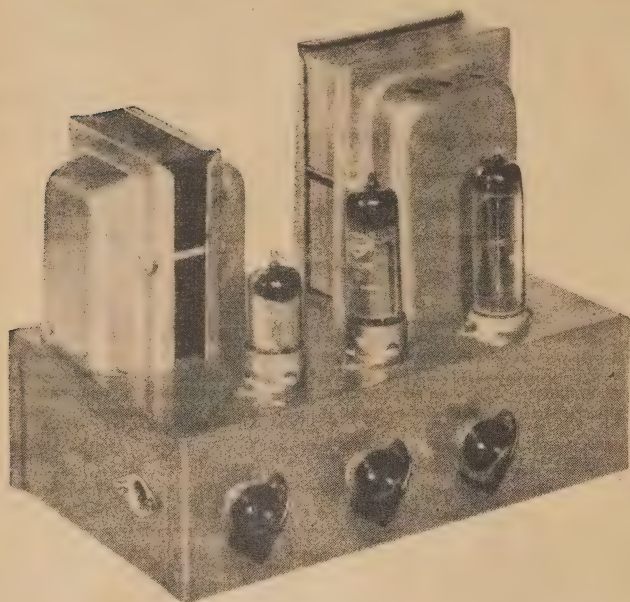
- VOLTAGE STABILISED SUPPLIES, by F. A. Benson, PhD, MSc, MIEE. First published in July, 1957. PRICE £3/12/6
- THE UHF PERFORMANCE OF RECEIVING VALVES, by W. E. Benham, BSc, FlinstP and I. A. Harris, AMIEE, AMIRE. Just published. PRICE £2/6/6
- TELECOMMUNICATIONS, by W. Fraser, BSc AMIEE (772 pages). Just published. PRICE £4/13/6
- MODULATORS AND FREQUENCY CHANGES, by Professor D. G. Tucker, DSc, MIEE. PRICE £2/6/6
- ELECTRICAL MEASUREMENTS AND THE CALCULATION OF ERRORS INVOLVED. By D. Kato, Dr Eng., AMIEE. Part 1 (DC) PRICE £1/10/0 Part 2 (AC). PRICE £2/10/0
- PHOTO-ELECTRIC MULTIPLIERS, by S. Rodda, BSc, FlinstP. PRICE £1/17/6
- THE THEORY OF NETWORKS IN ELECTRICAL COMMUNICATION AND OTHER FIELDS. 564 pages, 362 Figures. Just published. By F. Rogers, AMIEE. PRICE £4/13/6
- ELEMENTARY MATHEMATICS, by Lewis W. Phillips, MIEE, FlinstP. "Are your maths, inadequate for your radio or TV work? This title covers Algebra, Trigonometry, general maths, Logarithms and Graphs. PRICE £1/1/0
- TELECOMMUNICATION ECONOMICS by T. J. Morgan, AMIEE. This is the first book ever to appear on this subject, and will be welcomed by all those concerned with the development of telecommunication equipment, exchanges, etc. 452 pages. Just published. PRICE ... £3/12/6

We are the only specialist bookselling firm in Australia or New Zealand, dealing by mail order only, concentrating on electronics works.

Please send a cheque or money order for your requirements: do not send cash.

ELECTRONICS PUBLICATIONS (AUSTRALIA)
11 CADOW STREET, PYMBLE, N.S.W.

MULLARD '3-3' FROM U.R.D.



The Mullard '3-3' circuit has been developed from the 3-valve 3-watt amplifier which was designed to make a simple amplifier having a reasonably high quality. A few changes to the original design have resulted in improved low frequency stability and in less distortion at maximum output. The '3-3' circuit gives an output of 3 watts at a total harmonic distortion of 1%.

SUMMARY OF PERFORMANCE

Output Power (at 400 c/s)

3W at 1.0% total harmonic distortion.

Power Response

Flat from 100 c/s to 10kc/s.

Frequency Response

Flat within ± 1 db (relative to the response level at 1kc/s) from 35c/s to 30kc/s.

Tone Control

Maximum Treble Cut: Approx. 20db at 10kc/s.

Maximum Bass Boost: Approx. 15db at 70kc/s.

Sensitivity

100mV for 3W output.

Hum and Noise Levels

At least 70db below 3W.

Tested and recommended by U.R.D.

Suppliers to the trade for more than 20 years—Kits of parts now available from stock



UNITED RADIO DISTRIBUTORS PTY. LTD.

for streamlined service

Vast and varied stocks enable U.R.D. to deal with all orders more promptly and efficiently than ever before. Write, phone, telegram or visit—you'll find the service prompt and the advice helpful.

U.R.D. showrooms are set up so that a wide variety of Hi-Fi alternative combinations can be auditioned and compared.

U.R.D.'s experts will give you every assistance in choosing the perfect Hi-Fi rig to suit both taste and pocket.

U.R.D. are not only specialists in Hi-Fi but also TV, Radio and Electrical Appliances—from steam irons to TV Receivers.

U.R.D. SERVICE

Hi-Fi Loud Speakers—Goodmans and all other well-known brands.

Hi-Fi Amplifiers — Acoustical Quad II, Rogers R.D. Junior and all other brands.

Tape Recorders—Ferrograph.

Recording Tapes — MSS, Ferrograph, Magnetophonbrand, Scotch, E.M.I.

Turntables, Pickups, Speaker Cabinets

Radio Components,

All Electrical Appliances

Radio and TV

UNITED RADIO DISTRIBUTORS PTY. LTD.

Radio, TV and Electrical Wholesalers

175 Phillip Street, Sydney

Telephone—Counter Sales: BL3954, BW7318 ● Telephone Orders: BU7321

Telegrams—URD SYDNEY ● **Mail Orders**—Box 3456, G.P.O., Sydney.

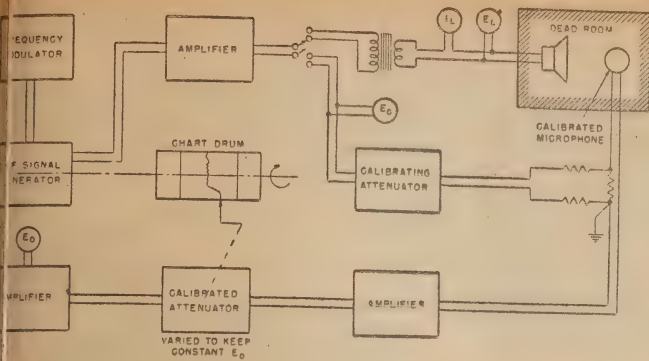


Figure 11. This block schematic diagram illustrates a typical setup for semi-automatic calibration of loudspeakers. The article discusses some of the attributes of the "Dead Room."

By G. A. BRIGGS
Managing Director
Wharfedale Wireless
Works Ltd.

it, and the condition of the record. Now that the same original recording is often available to the general public in different forms, variations in "characteristics" can easily be found by comparing the finished articles. The available forms include the 33 1-3 and 45 r.p.m. discs and 7 1/2 i.p.s. monaural and stereo tapes.

It is not at all strange that variations should crop up (it would be a miracle if they did not), but they are, in some cases, so great that it is difficult to believe that the same original material was involved.

If the bass on a record has been attenuated by narrow groove spacing in order to get a complete movement on one side of the disc, the remedy is to apply some bass boost to the replay and forget all about the supposed recording characteristics.

TAPES MORE SO!

Although we have used disc recordings to illustrate the point, our experience is that tapes display even wider variations, and top cut to avoid hiss is often necessary. In fact, there is ample evidence to show that the loudspeaker is still not the only imperfect link in a modern reproducing chain.

I think it was Robert Browning who wrote, "What's come to perfection perishes." (Actually, I know it was Browning because I have been thumbing through my Anthology again.) If the words are true, it is to be hoped that we are still a long way from perfection in the art of sound reproduction.

Similar reservations apply to program material from F.M. radio, which at its best provides the finest quality of reproduced music available in England today; but if you use a tuner preset to the three available transmissions ("Home," "Light," and "Third" programs) and switch from one to the other, the variations in frequency range and tonal quality are enormous, and the use of wide-range hi-fi equipment becomes im-

All About Audio and Hi-Fi

Part 4.—Listening tests and acoustic response curves, with method of using live room for useful measurements.

In the previous articles of this series we have examined the problems of production of sound as affected by the human ear and listening rooms. In other words, we have been dealing with sound waves after they have left the loudspeaker. We now come to the subject of this article which is the transients themselves.

There are many ways of testing loudspeakers, but unfortunately there is no single test which will give us all the answers. By comparison, testing an amplifier is child's play; pickups are about halfway between the two in elusiveness.

Useful speaker tests should include the following: Objective listening, response curves, impedance curves, transient response and resonances, directional effects, power handling capacity, and efficiency.

SPEAKER MOUNTING

All of these qualities are seriously affected by the method of mounting the speaker, a problem which will merit at least a complete article in itself. But let us deal with the questions in order. It is most important to remember that our raw material is far from perfect; with both radio and records we have to take what we can get.

The idea that records are turned out to a specified characteristic and can be played back perfectly by using an inverse of the characteristic always strikes me as fantastic—rather like be-

lieving in astrology, fortune-telling, or fairies.

At the recent Audio Fair in London I heard more than one demonstrator say, "This record is A.E.S. I am, therefore, playing it with A.E.S. correction and no further use of tone controls." This he would proceed to do with a virtuous air, no matter how awful the results.

I can see no sense in altruism of this sort. The only way to play records is to adjust the controls to suit the speaker, the room and number of people in

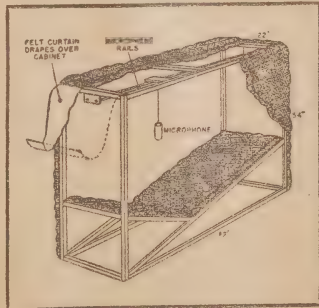


Fig. 12. Details on construction of absorbent enclosure used for the measurement of loudspeaker response in live rooms.

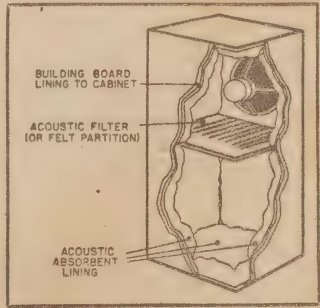


Fig. 13. Five cubic foot enclosed cabinet used for speaker mounting for response measurements with Fig. 12 enclosure.

Large

enough to reproduce the
FULL SOUND of a CONCERT HALL



... yet **SMALL** enough
to fit into
ANY setting

PHILIPS 9710M

8" DUAL-CONE HIGH-FIDELITY LOUDSPEAKER

Here is a loudspeaker which is compact and yet reproduces the full frequency range. It is the ideal solution if you have been previously prevented by lack of space from having your own high-fidelity system.

A special dual-cone design which distinguishes the Philips 9710M loudspeaker results in energy transmissions that are almost independent of frequency.

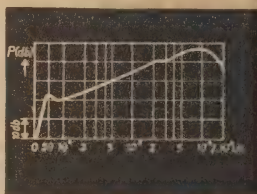


FEATURES:

Constant voice coil impedance. Long air gap for distortion-free reproduction. Very powerful "Ticonal" magnet. Low-resonance frequency. Perfect mechanical-acoustical damping. Very smooth response curve.

TECHNICAL SPECIFICATION:

Power-handling capacity . . . 10 watts. Voice coil impedance . . . 6-8 ohms. Frequency range . . . 40-20,000 c/s. Efficiency . . . 4.5% at 400 c/s. Flux density . . . 8,000 Gauss. Total magnetic flux . . . 97,000 Maxwells.



PHILIPS 9762M 12" Dual-Cone High-Fidelity Loudspeaker

This 12" 20-watt loudspeaker is ideally suitable where a large power handling capacity is needed.

Measured in an echo-free room at an input of 50 mW at 400 c/s, constant current and without baffle.

ela electro-acoustic division
PHILIPS ELECTRICAL INDUSTRIES PTY. LIMITED

SYDNEY • MELBOURNE • BRISBANE • ADELAIDE • PERTH • HOBART

P8066-5

possible without adequate means of tone control.

My experience is that when the quality on one program is excellent, the other two are usually pretty grim.

The longer I test and listen to loudspeakers, the less importance do I attach to the response curve as the final arbiter of performance. I suppose the reason is that we do not listen to music with a slide rule.

For instance, you cannot put a speaker in a box or on the end of a horn without making it sound as though it is in a box or on a horn.

You can "tune" the box (reflex enclosure or Helmholtz resonator to the expert); you can line it and fill it with soft absorbents until theoretical perfection is attained, but you still end up with a speaker in a box and no response curve will show the effect.

Of course, the bigger the box, the less "boxy" the results.

IGNORES COLOURATION

Fortunately, after a short period of listening the ear becomes punch drunk and no longer notices colouration; hence the ubiquitous radio receiver and radio-phonograph combination.

Incidentally, Mr P. J. Walker had a similar experience when working on the design of full-range electrostatic speakers.

He told me that he could easily increase the output at low frequencies by adopting some form of resonant enclosure of moderate size, but once this was done his new speaker sounded exactly like much cheaper moving coils and there was no point in proceeding.

I submitted the foregoing comments to Mr Walker for his approval, and he added the following very interesting note: "I did explore horns, vented enclosures, and completely sealed enclosures. They all introduced colouration except one, and that was a long and rigid tube built of brick with progressive fibreglass damping. This was very good, but not very practical."

As I have advocated bricks for many years as the cheapest and most effective way of avoiding panel resonance, I was interested to have this confirmation of their sterling qualities.

However, Mr Walker wisely decided to increase the size of his speaker and retain its character, which would not show on a response curve.

There are many different ways of mounting and loading a loudspeaker — often with murderous results — and arguments about their merits and shortcomings have gone on for so long that the newcomer to hi-fi must find the outlook rather bewildering.

DISCUSSION GOES ON

In fact, discussion has been just about as endless and indeterminate in this country as on the subject of capital punishment. I think the following comment by the Archbishop of Canterbury would apply in both cases:

"This long and distressing controversy . . . (over capital punishment) is very unfair to anyone meditating murder."

No doubt the situation will eventually be resolved by a general decision to look on the speaker and its mounting as one item instead of two, as is at present the case.

In spite of limitations, response measurement still remains an important aspect of speaker tests and requires conditions

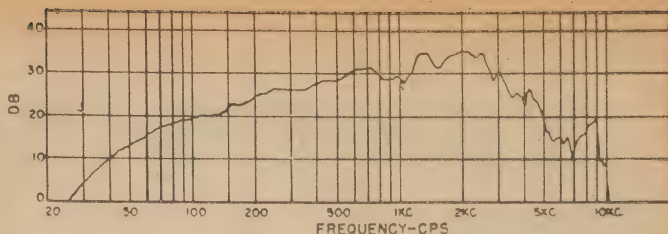


Fig. 14. Outdoor test employing a 15-inch loudspeaker in 5 cu. ft. closed cabinet standing on ground. Microphone 1 foot on axis. Input 1 watt at 400 cps.

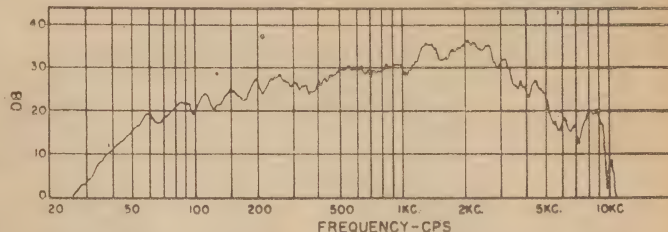


Fig. 15. Same setup described for Fig. 14 except indoors with absorbent enclosure.

approaching those of a free (acoustic) field.

These conditions are usually obtained either by operating out of doors, with the loud-speaker hoisted clear of the ground, well away from buildings and other reflecting surfaces; or by the use of anechoic chambers.

The first method approaches the theoretical ideal, but is fraught with practical difficulties due to the vagaries of the weather, wind, and ambient noises.

In Great Britain the weather is capricious, and suitable dry spells with little or no wind rarely coincide with periods of technical activity.

VERY COSTLY

On the other hand, anechoic chambers are very costly to construct. With fibreglass wedges at £1 each, a room of reasonable size may cost upward of £5,000. The outlay of capital and use of valuable floor space can hardly be justified for occasional use.

Furthermore, the average, medium sized anechoic chamber does not provide free-field conditions at frequencies below 100/150 cps, and measurements at very low frequency therefore require experienced interpretation.

Such limitations would hardly apply to the free-field room, described in Olson's "Elements of Acoustical Engineering," which is 32 feet x 20 feet x 20 feet after treatment (some room!) and I noticed during a visit to Bell Telephone Laboratories in 1953 that they have two

anechoic chambers—one large and one small.

I do not know how many of these rooms have been built here in England, but I have visited half a dozen as follows: BBC, G.E.C., G.P.O., Goodmans, Hawley Products, and Plessey, and Mr Cooke has had a look (forgive the rhyme!) at the National Physical Laboratory and the Philips installations.

The BBC room at its researches department in Kingswood Warren, Surrey, is interesting on account of the loose grid floor which can be removed for very precise work. (I have no precise information on what happens if you enter the dead room after the ironwork has been removed, except that shouts for help are inaudible.)

The walls, floor and ceiling are lined with fibreglass wedges 40 inches long and the useful room space measures 15 feet x 10 feet 8 inches x 7 feet 4 inches. This gives near-perfect free-field conditions down to 150 cps, but useful measurements can be made at much lower frequencies.

HEAVY ENCLOSURES

A rubber-tyred trolley is available for moving heavy enclosures. When work is in progress the entrance is closed by a heavy door also fitted with the fibreglass absorbent wedges.

To avoid the difficulties of open-air working and the high cost of building anechoic rooms, attempts have been made to carry out measurements in live

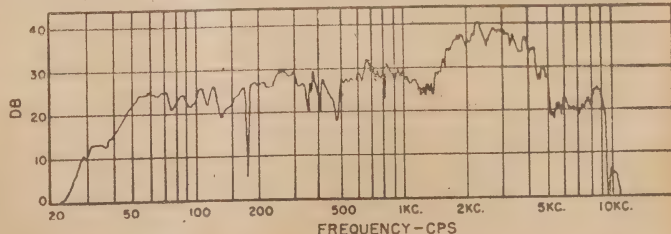
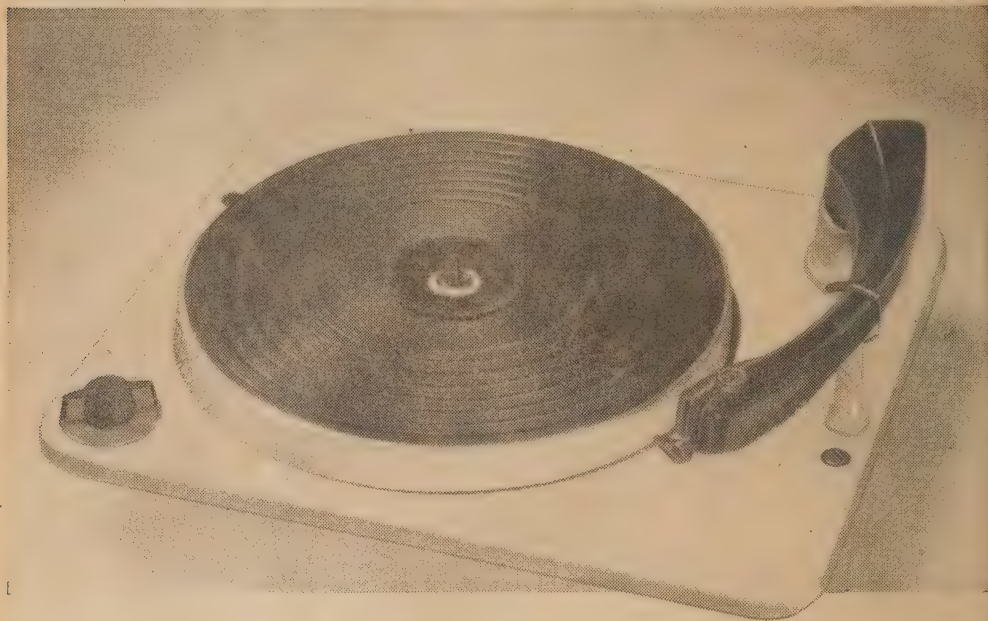


Fig. 16. Indoor curve of 15-inch speaker mounted in 9 cu. ft. brick corner reflex enclosure. Microphone is 1 foot on axis in absorbent enclosure. Input as above.

NOW! At reasonable cost you can enjoy

GENUINE 4-SPEED HIGH FIDELITY



THE
NEW



H.F.8

HIGH FIDELITY
4-SPEED
RECORD PLAYER

Bringing you the features and reproduction quality you have been waiting for! Made in Australia and designed specially for Australian "Hi-Fi" requirements, and backed by the world-wide B.S.R. experience in quality motor manufacture.

QUALITY FEATURES OF THE H.F.8:—

★ Vibration-free electronically balanced 4-pole motor ★ 9" Heavy steel turntable rotates on ball-bearings for smooth operation ★ Rumble reduced to an absolute minimum ★ Air-cushioned rubber mat protects records ★ Flutter and wow completely eliminated ★ Neutral position eliminates flat spots on jockey pulley ★ Four speeds—16 2/3, 33 1/3, 45, 78 ★ Sensitive silent B.S.R. automatic stop ★ Micro-finish needle bearings on pickup arm ★ Die-cast arm eliminates warp wow, and allows tracking pressures as low as 3 grams ★ Adjustable stylus pressure ★ Choice of pickup cartridges—suits all with 1" mountings ★ Spectacular true high fidelity performance can be obtained when fitted with the Goldring Variable Reluctance Cartridge "555" in conjunction with a suitable amplifier.

See the H.F.8 at leading radio houses

Technical enquiries to the sole Australian Distributors:—

PRICES:

1. H.F.8 Player with latest Crystal Cartridge (30-10,000 c.p.s.) **£13/5/-**
2. As above, but with Diamond L.P. Stylus **£19/15/-**
3. H.F.8 player with Goldring Mu-Metal shielded Variable Reluctance Cartridge No 555 (20-16,000 c.p.s.) **£16/5/-**
4. As above, but with Diamond L.P. Stylus **£22/15/-**

GOLDRING ENGINEERING (AUST.) PTY. LTD.

449 Kent Street, Sydney. BX1275-6

oms, the effects of standing waves being minimised by placing the microphone only a foot or so from the loudspeaker and by screening off the space around them with sheets of sound absorbent having an appropriate flow resistance.

Mr D. E. L. Shorter of the BBC owned some response curves taken in this way. The speaker, which had an vented cabinet, was mounted as far possible from all obstacles.

Using a velocity microphone to minimise room effects, the curve obtained is within 2 db of the corresponding curve taken in the dead room. The close microphone position introduces a spurious bass rise (which can be allowed for), together with some other errors at frequencies where the cone breaks up. However, these errors are nearly constant for a given type of speaker so that the method can be useful for production checking.

SPECIAL ENCLOSURE

We find that we can get a lot of reliable information from curves taken in the absorbent enclosure illustrated in Fig. 12, which consists of a light wood framework covered with sound-absorbent material, with extra oblique layers of the same material above the floor. The frame is built of solid wood (2in x 2in) covered by double layers of resinsind fibreglass each 1in thick. It is rigid enough to permit measurements with loud-speaker/microphone spacings up to one metre (39.37 inches) and 30 degrees off axis in a vertical direction at distance.

In a live room, sound from the loudspeaker reaches the microphone both directly and after reflection from the room boundaries. The purpose of the enclosure is to increase the ratio of direct to reflected sound. Obviously, sound waves reach the microphone directly with attenuation, but reflected sound is attenuated during its passage through the absorbent screens.

Because of close proximity of the floor, it is advisable to use several layers of absorbent material on the bottom of the enclosure.

A further improvement in the ratio of direct to reflected sound can be achieved by using a directional microphone with its axis adjusted to discriminate in favour of direct radiation.

LITTLE TO CHOOSE

There is no advantage in using a cardioid microphone as compared with a figure-8 type, because both have approximately the same ratio of direct/reflected pickup. The velocity type microphone has two thin lobes (front and back), whereas the cardioid has one fat frontal lobe, which in some cases can be a disadvantage because it picks up more floor reflections.

A suitable microphone is the Standard Telephones and Cables ribbon type 038A, which has a uniform response from 40 to 12,000 cps to sound at normal incidence to the ribbon. Satisfactory direct/reflected sound pickup can be achieved by keeping the loud-speaker/microphone distance as low as one foot, or measurements up to about 2,000 cps. Above this frequency such a small distance gives erroneous results because of the reflection effects taking place at the surface of the cone, and it is advisable to increase the microphone spacing to some three feet.

Fortunately, we are able to do this without introducing serious irregularities in the response reading, because the absorption coefficient of the fibreglass screen increases rapidly with frequency.

Where measurements are required at frequencies higher than 12,000 cps, we use a miniature Rochelle Salt sound cell microphone, or a miniature Rochelle Salt "X"-cut expander block. Both these instruments are small enough to have negligible diffraction effects up to about 20,000 cps, and both respond to much higher frequencies.

The loudspeaker under test may be mounted in the wall of the room — a perfect and simple infinite baffle — or it can be placed in a totally enclosed cabinet similar to the one illustrated in Fig. 13. This has a volume of 5 cubic feet, is rigidly braced and lined with building board to prevent panel resonance, and acoustically treated to avoid standing waves.

The absorbent enclosure of Fig. 12 can, of course, be placed in front of a loud-speaker already mounted in a corner cabinet or horn.

The response curves of Figs. 14 and 15 show the results obtained. A 15in foam-surround speaker was mounted in the 5-cubic foot enclosure and curves were taken in the open air (free-field) and in the lab (with absorbent enclosure). Incidentally, this 15in unit is normally recommended for use up to 1,000 cps only, because of the rise in output in the 1,000 and 5,000 cps region.

ROOM EFFECTS

It will be observed that the irregularities introduced by the room are about plus or minus 2 db up to 1,000 cps, and less than plus or minus 1 db above that frequency.

The severe low-frequency roll-off below 100 cps is due to the closed box which is small for a 15in speaker. Fig. 16 shows the output from the same unit mounted in a 9-cubic foot corner reflex enclosure built of bricks and mortar; at 50 cps the output is some 8 db higher.

It will be appreciated that this indoor method of taking curves with the microphone fairly close to the speaker makes it impossible to include the low-frequency output from the vent of a reflex enclosure in the main response curve. The vent of this 9-cubic foot enclosure resonates at around 35 cps and greatly enhances the output in the region below 50 cps.

(To be continued)

Measuring the Metre

THE standard metre is deposited in a cellar deep below ground at Sevres, near Paris.

A proposal has now been put forward to define the standard metre. This would make the metre "equal to 1,650,763.73 times the wave length in a vacuum, of the radiation of Krypton 86."

The present standard metre, a report declares, provides accurate measurement within one to two millionth parts. The new standard recommended would, it is claimed, prove accurate to within "some millionths of a millionth."

Almost universal, the metre was first set up as a standard during the French Revolution. It was designed to be the ten millionth part of a quarter of the earth's meridian.

New Instrument Cases and Fittings

Vacuum Tube Voltmeter, R. and H. type, engraved enamelled front panel with all indications and holes.

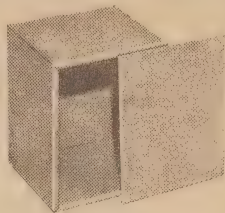
19/6, plus 12½ S.T., plus 1/4 post. Sweep and Marker Generator, R. and H. type, engraved enamelled front panel with indications and holes.

19/6, plus 12½ S.T., plus 1/4 post. Oscilloscope, R. and H. type, engraved enamelled front panel, with all indications and holes.

19/6, plus 12½ S.T., plus 1/4 post. Multimeter, R. and H. type, engraved enamelled front panel, with all indications and holes.

19/6, plus 12½ S.T., plus 1/4 post.

Metal Utility Cabinets



Finished in grey Hammercock type colour with removable lid, louvred sides, welded corners.

MC5A R. and H. type, 9 x 6 5-8 x 5½ ... 18/9, plus 12½ S.T.
MC82A R. and H. type, 13 x 8 x 6 7-8 ... £1/12/3, plus 12½ S.T.
MC87A R. and H. type, 15 x 10 x 8 £2/2/- plus 12½ S.T.

New Sizes Sloping Front Cabinets

Finished in Grey, 1 5-8in front, 1 5-8in top. Both fixed, removable front panel.

SF7A R. and H. type, 7½ x 7½ x 7½, for 8 x 7 front panel, for multimeter

£1/1/- plus 12½ S.T.

SF79A 9½ x 7½ x 7½, steel front panel.

£1/4/6 plus 12½ S.T.

SF71A 11 x 7½ x 7½ steel front panel.

£1/9/6 plus 12½ S.T.

SF8A 13 x 8½ x 8½ steel front panel.

£1/11/6 plus 12½ S.T.

SF10A 18 x 10 x 10, with steel front panel

£2/6/- plus 12½ S.T.

AUDIO

Linear output transformer, full fidelity, tapped, 2 positions, one for beam tubes, second for pentodes. Uncased. Weight approximately 5½lb.

£4/5/- plus 25% S.T.

Step down transformer, 3 amp, 240 volts to 12 and 6 volts.

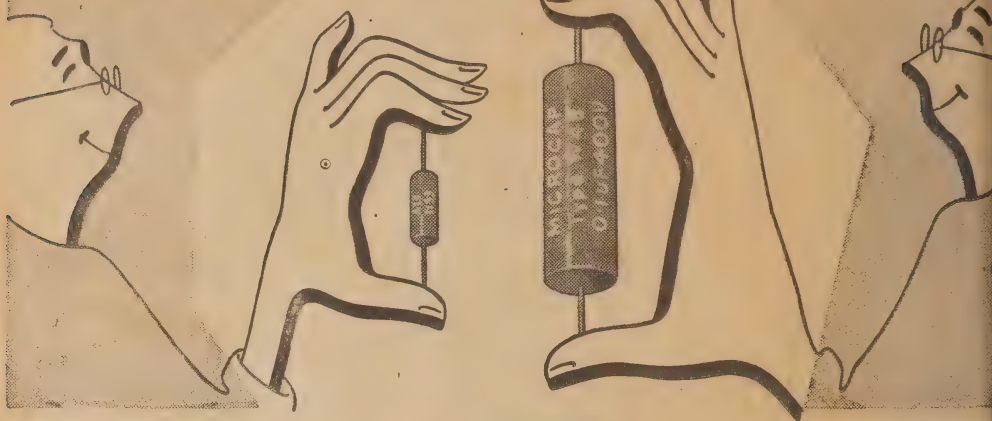
30/- plus tax 25%

R. H. Oxford & Son
PTY. LTD.

97 Marriott St., Redfern,
N.S.W.

MX3764

Did you know



that the **SPACE SAVING** *Microcap* range extends from the smallest right up to 2 μF capacitance?

A.E.E. TYPE W99

MINIATURE METALLISED PAPER CAPACITORS

are available in working voltages of 200, 400, 600 Volts D.C. and 300 Volts A.C. in values up to .04 μF . They have a "self-healing" feature which allows the capacitor to withstand accidental over-voltage. Type W99 are capable of operation in temperatures of up to 85°C. (185°F.).

A.E.E. TYPE W48

MINIATURE METALLISED PAPER CAPACITORS

cover the range .05 μF to 2.0 μF in working voltages of 200, 300 and 400 Volts D.C. They also feature the valuable "self-healing" property, and 85°C. operation. Type W48 provide higher capacitances in a smaller size; hence more efficient filtering for the available space.

Microcap

CAPACITORS

Wide range covers requirements of modern design.

M11.

*Registered Trade Mark

Manufactured under licence from A. H. Hunt
(Capacitors) Ltd., London, by

AUSTRALASIAN ENGINEERING EQUIPMENT CO. PTY. LTD.
476 LATROBE STREET, MELBOURNE. FY 2638.

N.S.W. Agents:

Wm. J. McLELLAN & Co. Pty. Ltd., 126 Sussex St., Sydney. BX 1131

THE COLOR CODING OF RESISTORS

Most resistors in use in Australia are color coded according to the system adopted by the Radio Manufacturers Association (R.M.A.). At the request of many readers, the basis of this code is explained below.

SEPARATE colours are used to represent the numerals 0-9, and the colour combinations are used to express the resistance value directly in ohms. The colours have the following significance: black 0, brown 1, red 2, orange 3, yellow 4, green 5, blue 6, violet 7, grey 8, white 9.

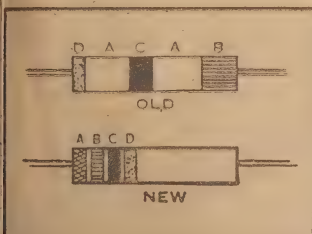
In the older system the first figure of the resistance value is represented by the body colour (A). Thus, if the main body of the resistor is red, it follows that the first figure in the resistor value must be "2."

The second figure in the resistance value is shown by the end colour (B). The significance of the individual colour remains unaltered, so that, if our previously mentioned red resistor has a green end, the first two significant figures would be "25."

COLOR DOT OR BAND

The color dot or band at the centre of the resistor (C) shows the number of noughts which have to be added after the first two significant figures.

A black dot would indicate no noughts and therefore the resistance value would be merely 25 ohms. With a brown dot, the resistance value would be 2.5-0 or 250 ohms. In the case of a 2,500 ohms resistor, the dot would obviously have to be red, and so would not be apparent in the red body. Hence, if no dot is apparent, it can be assumed that the colour of the dot is the same as that of the body.



By way of example, one may encounter a red resistor with a black end. Referring back to the list, the first two significant figures must be "20". The dot must be assumed to be of the same colour as the body... red. This signifies two noughts, so that the value becomes 20-00, equals 2,000 ohms.

ANOTHER EXAMPLE

To take another popular example, a green resistor with black end and yellow dot or band is 5-0-000 equals 500,000 ohms or 0.5 megohm.

It will be apparent that the coding system does not lend itself to resistance values requiring more than two significant

figures ahead of the ciphers.

The accompanying table sets out the colours and figures in a form which

RESISTOR COLOUR CODE

Table showing popular preferred values of resistors in the R.M.A. color code.

Resistance in ohms	A	B	C
2200	Red	Red	Red
3300	Orange	Orange	Red
4700	Yellow	Violet	Red
6800	Blue	Grey	Red
10,000	Brown	Black	Orange
15,000	Brown	Green	Orange
22,000	Red	Red	Orange
33,000	Orange	Orange	Orange
47,000	Yellow	Violet	Orange
68,000	Blue	Grey	Orange
100,000	Brown	Black	Yellow
150,000	Brown	Green	Yellow
220,000	Red	Red	Yellow
330,000	Orange	Orange	Yellow
470,000	Yellow	Violet	Yellow
680,000	Blue	Grey	Yellow
1 Megohm	Brown	Black	Green
1.5 Megohm	Brown	Green	Green
2.2 Megohm	Red	Red	Green
3.3 Megohm	Orange	Orange	Green
4.7 Megohm	Yellow	Violet	Green
6.8 Megohm	Blue	Grey	Green
10 Megohm	Brown	Black	Blue

simplifies the transfer from colour code to resistance value and vice versa. The second table shows the colour codes directly for a selection of the most commonly encountered resistors in the "preferred values" range.

To simplify production the older marking system has now been replaced by a new system which presents the colours in a somewhat different manner.

Instead of being applied to body, end and band, the significant colours are applied as three parallel bands around the resistor and toward one end. The body colour of the resistor has no significance whatever.

SAME SIGNIFICANCE

Hold the resistor so that the colour bands are toward the left and read off the colours from the left to right. The colours have the same significance as before, so that no difficulty should be encountered on this score.

Assuming that the colour bands on a resistor were, left to right, red, green and yellow, the resistance value would be 2-5-000 or 250,000 ohms. Occasionally a fourth band is added, on the right, of either silver or gold. A silver band signifies that the resistance value is within 10 per cent of the marked value, while a gold band indicates a 5 per cent tolerance.

The use of colour bands instead of body, end and dot colours should occasion no confusion, provided you remember to hold the resistor with the bands toward the left and read off the colours from left to right.

R.M.A. RESISTOR COLOUR CODE—Values in ohms

Body Colour	First Digit	End Colour	Second Digit	Dot Colour	Remaining Digit
Black	0	Black	0	Black	—
Brown	1	Brown	1	Brown	0
Red	2	Red	2	Red	00
Orange	3	Orange	3	Orange	000
Yellow	4	Yellow	4	Yellow	0,000
Green	5	Green	5	Green	00,000
Blue	6	Blue	6	Blue	000,000
Violet	7	Violet	7	Violet	0,000,000
Grey	8	Grey	8	Grey	00,000,000
White	9	White	9	White	000,000,000

RESISTOR WATTAGE RATINGS

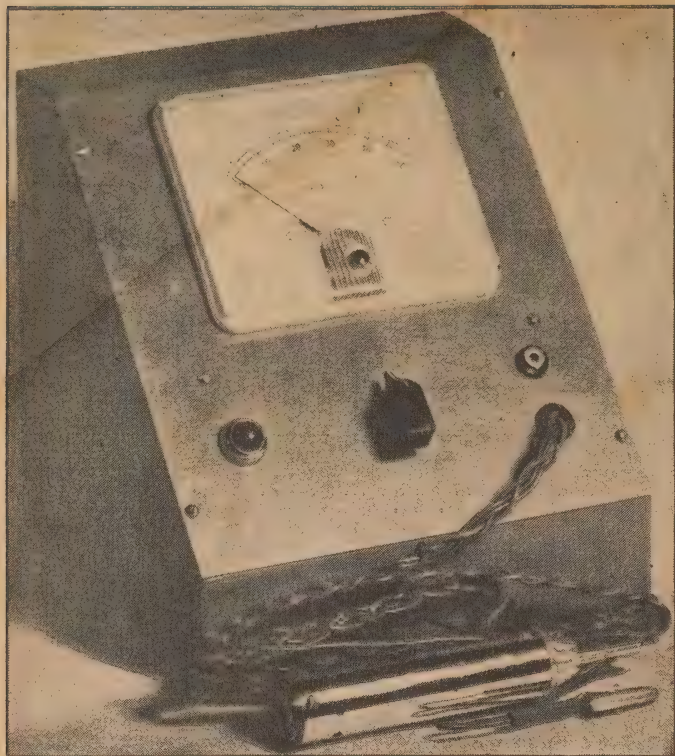
Depending on their size and construction, resistors are able to dissipate a certain amount of heat without physical damage or undue changes in their electrical resistance.

The wattage involved can be calculated by squaring the voltage figure across a given resistor and dividing the result by the resistance in ohms.

Alternatively, the current in milliamps through the resistor can be squared, multiplied by the resistance in ohms and divided by 1 million.

As a general rule it is not advisable to operate resistors in confined spaces at more than about half their rated maximum dissipation. In case of doubt, greater reliability can be expected if a larger resistor can be installed.

Where the dissipation approaches or exceeds 1 watt, the limit for standard carbon resistors, two such resistors can be used in parallel, each double the resistance value required. Thus two 50,000 ohm 1-watt resistors in parallel give an effective value of 25,000 ohms at 2 watts.



The complete instrument, consisting of power supply and meter in the bench case, and the measuring circuitry in the probe. The single control adjusts the meter zero.

bandwidth possible for a given order of gain.

Since the lowest practical values are still significant the problem must be tackled in another way. The normal procedure is to add inductance to the circuit to form, with the stray "C," a resonant circuit near the upper limit of the response. When all values are carefully chosen it is possible to extend the response by a really worthwhile factor and without serious peaks.

NEED TO MEASURE

However, in order to combat the stray "C" we obviously need to know its value fairly accurately. Some of the contributing factors, such as valve inter-electrode capacitances, may be known and may serve as a basis for calculation but wiring, valve sockets, coupling capacitors, etc., all contribute unknown quantities which may be equal to, or greater than, the known ones.

In these circumstances it may be necessary to resort to lengthy processes of trial and error, before suitable value of inductance may be selected, plus the fact that there is no easy way of determining the actual cause of the stray "C," or whether there is any way in which it can be reduced if this should be desirable.

But if there is a convenient means available by which this can be measured then things become a good deal simpler. Knowing the amount of "C" present, we

Probe Type Capacitance Meter

Here is a piece of test equipment which will appeal particularly to the laboratory worker and advanced amateur. It is simple to build, non-critical in operation, yet extremely sensitive and sufficiently accurate for all normal applications.

MODERN electronic circuitry, such as employed in TV and other VHF applications, and to a lesser extent even in the humble broadcast receiver, can be extremely critical in some respects, and the original physical design may need to be followed very closely if the original results are to be duplicated.

One very elusive factor is "stray C" — the small amounts of capacitance existing between adjacent wires, wires and the chassis, components and the chassis, valve pins, adjacent components, and so on, in an almost endless variety.

EFFECT OF STRAYS

The amount of this capacitance is generally small — seldom more than 5 pf from any single source — yet it can have a marked effect on the final performance, either singly or in conjunction with other "strays." One typical example is the stray capacitance between the grid and plate pins of a valve socket. When present in a high gain IF amplifier stage, this can often be sufficient to cause serious instability.

Furthermore, the capacitance across a moulded socket may be substantially higher than that of a wafer type, and we have seen more than one case where the substitution of the latter for the former was all that was necessary to cure a bad case of instability.

Another example is the video amplifier in a TV set. This may need to have a bandwidth as high as 4 Mc, but the actual bandwidth obtainable from a conventional resistance-capacitance amplifier is limited almost entirely by the stray "C" around the circuit components. If this could be eliminated there would be almost no limit to the

can then nominate, by calculation, suitable value of inductance to provide the required resonance and select a value from the preferred range of commercial windings.

Alternatively, if the amount of "C" appears abnormal, steps may be taken to find out why this is so and to what extent it may be reduced. In this wiring and components may be placed for the best possible results.

TUNED CIRCUITS

Yet another problem concerns the design of ordinary tuned circuits where it is desired to obtain the maximum possible coverage with a given tuning capacitor. In this case, the stray "C" can be very important and a means, first of measuring it and, secondly, of determining the major contributing factors, can be extremely valuable.

These are only a few typical examples many others will occur to individuals when they consider the problems they encounter in their own particular field.

Having presented the problem, I

by Philip
Watson

thing is to consider suitable ways and means of tackling it in an ordinary R/C bridge could be considered, but there are several reasons why it is not ideal. Not being designed to work specifically in the region we are considering, there is often considerable doubt as to the accuracy of such an instrument at very low values. This is made worse by the need for long connecting leads between the instrument and the circuit under test.

A far better approach is to produce an instrument specially designed for this job and which, as well as being sufficiently sensitive and accurate within itself, can be connected to the circuit without effectively adding any capacitance to it.

In our search for such an instrument we came across two designs by Mr L. Medina, of the C.S.I.R.O. (Proc. I.R.E. Inst., August, 1953), both directed at the same problem, but approaching it in different ways. One design in particular appealed to us and we mocked up the circuit for a rough trial.

Our immediate impression was that Mr Medina's claims were, if anything, conservative and that the device was extremely sensitive, accurate, and non-ritical. It seemed to be just what we were seeking.

DIRECT READING

It is a direct-reading instrument, having a single range measuring up to 50 f. The scale tends to expand at lower values, making values of 1 pf. or less easily detectable. In practice, this means that it will easily detect the stray "C" between an unused contact and the frame of a wafer switch. More than that, it will detect the difference between contacts close to the assembly bolt, and those further from it.

It is made in two sections, a power supply and the meter in a bench case, and the vital measuring circuitry in a small probe. In this way the instrument can be brought right to the circuit under test and critical connecting leads are avoided.

A voltage regulator in the power supply takes care of line voltage variations, and the instrument is very stable in use. A small amount of drift in the meter zero takes place during the first few minutes of warm-up, but this quickly settles down and should not need adjustment thereafter. However, it is so sensitive that placing the probe close to the main box or other earthed objects can produce an appreciable meter movement, and which can be mistaken for drift.

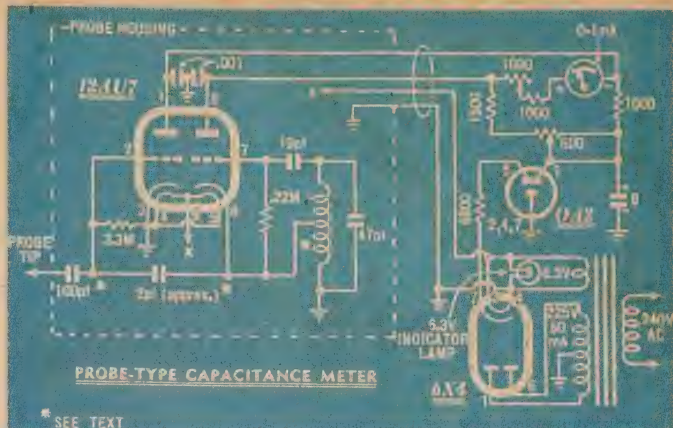
HOW IT WORKS

The basic principle on which the instrument works is quite ingenious. A twin triode is housed in the probe, one half functioning as an RF oscillator at about 2 Mc, and the other half as a simple grid rectification valve voltmeter.

Signal from the RF oscillator is fed into the valve voltmeter via a capacitance type voltage divider, consisting of the 2 pf from the centre tap of the oscillator coil as one section, and the 0.001 pf and the unknown "C" as the other half. (The main purpose of the 0.001 pf is to avoid overloading the meter in the event that the probe shorts to chassis, and also to expand the scale for low values.)

Fairly obviously, the amount of RF energy fed to the grid of the valve voltmeter will depend on the amount of

CIRCUIT OF CAPACITANCE METER



The circuit is quite simple, and the operation is explained in the text. The left section of the 12AU7 is the valve voltmeter, and the right section the oscillator. Note the balanced meter circuit between the valve plates.

"C" forming part of the divider, i.e., the unknown value. This in turn will vary the plate current of the valve voltmeter and which may be read on a suitable meter calibrated directly in "pf".

In order that this change in plate current should not be masked by the standing current, the meter is connected in a balanced circuit so that it is at zero when the standing current is normal. When the current increases the meter registers this only.

To provide the balanced condition, the meter is connected between the two plates of the valve, and a variable 500 ohm resistor is used to vary the voltage applied to one plate (the oscillator) until it is equal to that of the other. Under these conditions the meter will read zero.

The meter is a standard 0.1 mA variety and its sensitivity in the circuit is controlled by a suitable amount of series resistance. In our case this is a 1000 ohm pot. and a fixed 1000 ohm resistor, allowing the final sensitivity to be controlled for correct full scale

deflection.

The remainder of the circuit is a simple power supply, delivering 150 volts from a voltage regulator, plus the normal filament supply for the rectifier and twin triode.

From the theory we come to the practical construction of such a unit, with particular emphasis on the use of standard commercial components. The probe, in particular, gave us some food for thought, since the nearest available type was smaller than that suggested by Mr Medina. On the other hand, the current trend toward miniaturisation has produced many small components which were not readily available in 1953, and we felt we might just get away with it.

In fact we did, but we suggest that those who have workshop facilities available might still prefer to make a slightly larger unit. The original specifications were for a housing 1 1/2 in I.D. and 5 1/8 in. long. We used a Jabel type 4X7/8, which is 7/8 in. I.D. and 4 in. long. This is large enough, but only just.

PARTS LIST

- 1 Sloping Panel meter case 7 1/4 in. x 7 1/4 in. (wide)
- 1 Panel 8 in. x 7 in.
- 1 Chassis 4 in. x 6 1/2 in.
- 1 Power transformer 225V 50mA 6.3V 2A.
- 1 Probe, Jabel 4X7/8 or similar.
- 1 Aerial coil with 2 section secondary (RCS E356 or similar).

VALVES

- 1 12AU7
- 1 6X4
- 1 OA2

RESISTORS

- 1 3.3M 1/2W.
- 1 .22M 1/2W.
- 1 6800 ohm 1W.
- 1 1500 ohm 1/2W.
- 2 1000 ohm 1/2W.
- 1 1000 ohm pot.
- 1 500 ohm pot.

CAPACITORS

- 1 8 mf electrolytic.

- 1 2 x .001 Hi-K ceramic.
- 1 100 pf NPO or LOW-K type (See text).
- 1 47 pf NPO or LOW-K.
- 1 47 pf NPO 5% or better (optional).
- 1 10 pf NPO or LOW-K.
- 1 2 or 1.8 pf NPO.
- 1 Min 9 pin moulded socket (Teletron ST29 or similar).
- 2 Min 7 pin sockets.
- 2 Bakelite spacers 1 in. x 5/16 in. tapped 1/8 Whit.
- 1 Tip jack terminal.
- 1 Indicator bezel, lamp holder, and lamp.
- 1 Pointer knob.
- 4 3/8 in. Grommets.
- 2 3 Tag terminal strips.
- 1 4 tag terminal strip.
- 1 5 tag terminal strip.
- 8 mm Plastic tubing.
- Power cable, hook up wire, nuts and bolts, etc.

Famous "CHANNEL MASTER" TV Aerials & Accessories

EVERYTHING ON DISPLAY to make inspection & selection EASY

BROAD BAND

MODEL	DESCRIPTION	PRICE
300	Rebulet Eir	4 15 0
310	Dual Flector	9 3 0
313	Super-Fan	9 16 0
315	City Veer	7 15 0
315RT	City Veer	7 5 0
330	Rainbow	21 0 0
331	Super Rainbow	31 6 9
350	7 Element T.W.	42 15 0
351	5 Element T.W.	32 10 6
352	3 Element T.W.	22 18 6
626	Challenger 6	12 13 6
10026	Challenger 10	16 9 0
3900	Showman	15 10 0

HIGH GAIN

Z MATCH YAGI

602	5 E.L.B. Yagi	13 6 0
607/9	5 E.L.B. Yagi	9 21 6
1007/9	10 E.L.B. Yagi	14 12 0
1022	10 E.L.B. Yagi	27 19 6

STAND-OFF

INSULATORS

(Metal thread or wood-screw)

9601	3 1/2 in long each	1 4
9603	5 1/2 in long each	1 5
9604	7 1/2 in long each	1 6
9605	12 in long each	1 8

MASTING

Lengths to be specified

MODEL	DESCRIPTION	PRICE
9600	1 1/4 in 18 gauge hot dipped galv. tube in 8 ft lengths	1 7 6
	1 1/4 in 16 gauge hot dipped galv. tube in 15 ft lengths	2 12 3

STRAT-O-MATIC STEEL MAST

Complete with Riggering Assembly

1620	20 feet	9 2 9
1630	30 feet	13 11 9
1640	40 feet	18 7 9
1650	50 feet	24 8 0

1 1/4" diameter

ALUMINIUM TUBE

(not fabricated)

9200	5 feet	1 9 0
	7 feet 6 inches	2 3 6
	10 feet	2 18 0
	15 feet	4 7 0

ALUMINIUM STRAT-O-MATIC MAST

Complete with Riggering Assembly

MODEL	DESCRIPTION	PRICE
9220	20 feet	15 10 6
9230	30 feet	22 13 0
9240	40 feet	28 4 3
9250	50 feet	38 7 0

MOUNTS

9013	Aerial Tilt Mount	14 6
9051	Bargeboard Stubb Mount	1 11 0
9060	"Z" Type Chimney Mount	3 19 6
9062	"Y" Type Chimney Mount	4 5 9
9066	"U" Type Chimney Mount	4 14 0
9501	10-foot Tower Sections	21 18 6
9510	Foot Mountings (Set of three for towers)	3 12 0
	Nests, Crossed	9 6
9511	Mounting Spiders	
	Pair for Towers	3 12 0

ACCESSORIES

MODEL	DESCRIPTION	PRICE
9012	Guy ring assemblies	14 9
	1 1/4 in to 2 in — as above	
	1 1/4 in to 2 in	1 3 9
9081	Plate-Guy Wire Anchor	2 6
9090	Rope clips and grips	2 7
9658	Clip, title for S.O. Insulators each	1 6
9659	Brackets, gutter for S.O. Insulators	1 6
	Riggering assemblies — Telescopic Masts	
	20 feet	1 3 9
	30 feet	1 6 3
	40 feet	1 18 9
	50 feet	2 9 6
9665	Turn buckles	5 0

COMPLETE RANGE of STACKING RODS IN STOCK

WARBURTON FRANKI

(MELB.) LTD.

359 LONSDALE ST., MELBOURNE — PHONE MU 9664



NEW, REVISED, EXPANDED! RADIO & TELEVISION ENGINEERS' REFERENCE BOOK

**FREE FOR
7 DAYS**

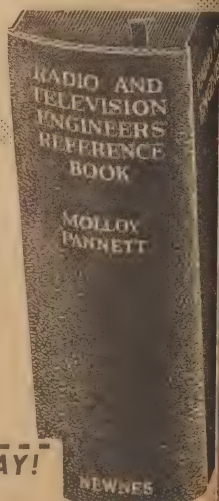
BY 41 SPECIALISTS!—THE MOST COMPLETE UP-TO-DATE PRESENT WORK OF ITS KIND — FOR THOSE INSTALLING, SERVICING, DESIGNING, MANUFACTURING TV & RADIO.

Be one of the FIRST TO EXAMINE IT, without cost, without obligation.

EXTENSIVE REVISIONS and a MASS OF NEW MATERIAL. Critical Developments from now matured experience in all aspects. New accomplished and revealing articles cover Communications Theory, COLOR TV, PRINTED CIRCUITS, Components. Also NOW IMPORTANT & TOPICAL design of VHF-FM; COMBINED AF-FM receivers in GREATLY EXPANDED BROADCAST RECEIVER SECTION; single and independent SIDE-BAND in COMMUNICATION TRANSMITTERS Section; MICRO-WAVE TV & COMMUNICATION RELAY in Broad-band systems and Waveguides sections; NON-ENTERTAINMENT TV, etc., etc.

INCLUDES: Formulae, calculations, electron optics, studio equipment, transmitter power plant, aerials, amateur radio equipment, waveguides, V.H.F. transmitter-receiver equipment, commercial H-F links, navigation and radar, industrial TV, valves, tubes, transistors, diodes, interference, magnetic and disc recording, radio and TV installation and servicing, projection TV, units and symbols, etc., etc.

It is impossible to list the very comprehensive contents and expansive sections of THIS NEW OUTSTANDING and AUTHORITATIVE WORK — that's why you are offered a chance freely to examine it in your own home and without obligation. Take your opportunity, POST THE COUPON NOW!



RTTB 6

Place X where it applies.

Householder	
Tenant	
Living with parents	
Lodging address	

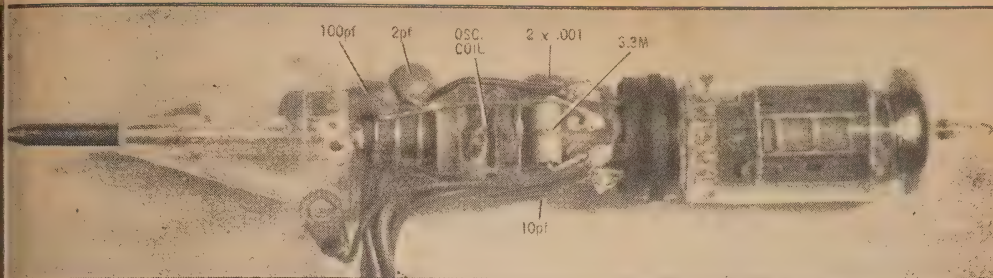
POST THIS COUPON TO-DAY!

To: GEORGE NEWNES (AUST.) PTY. LTD.
Newnes House, 20-22 Margaret Street, Sydney.
Please send me Newnes NEW RADIO & TELEVISION ENGINEERS' REFERENCE BOOK. It is understood that I may return the work within eight days. If I keep it I will send a first payment of 6/- eight days after delivery and 15/- monthly thereafter, until £5/6/- has been paid.
Cash price, £5/1/-.

Name _____
Address _____ (Print clearly) _____ State _____
Occupation _____
Signature _____ (Or your Parent's signature if under 21.)

- NOW more than 1,800 PAGES
- NOW more than 2,000 DIAGRAMS
- NOW more than 2,500 CROSS REFERENCE INDICES for radio reference
- NOW 46 EXPANDED SECTIONS

INTERNAL PHOTOGRAPHS OF THE PROBE ASSEMBLY



This picture shows the probe withdrawn from its metal case and identifies many of the components.

In a larger unit the placement of the parts will not be so critical, but if the commercial unit is used we suggest that the following points concerning the assembly be studied carefully.

The oscillator coil was made from a commercial aerial coil, an RCS type #56. The primary winding (a single turn) was removed, as was the base of the former for the latter. This leaves two series connected windings on a plastic tube, which extends 1/8in. beyond one end and 9/16in. beyond the other. The junction between the two windings is now located and cut as far from the inside termination as possible. One turn is removed from the other coil to leave a little more wire to play with, and the two wires joined together again. This gives us our centre tap. When retuned with a 47 pf capacitor this combination will tune to about 1.8 Mc., which is quite satisfactory for our purpose.

The next point is the mounting of the coil and valve socket. Two bakelite spacers were used for this, though a single piece of rod, suitably tapped and ground, would be better. Our pieces are each 1in. long, 5/16in. diameter, and tapped 1/8 Whit. through the centre. They are normally available as a standard item.

One of these needs to be cut down to 5/8in. long and turned down until it is a firm push fit inside the central field of the valve socket (slightly under n.). This latter operation can be carried out with nothing more elaborate than a power drill and a file. If the jaws of the drill will not take the 5/16in. diameter, run a long 1/8in. machine

screw through the spacer and clamp this in the drill.

The only modification to the other spacer is to cut three shallow grooves in it near one end. These are to permit the fitting of three "terminal rings"—rings of about 22g tinned copper wire used to terminate the incoming leads.

The cuts are most easily made with a hacksaw blade while the spacer is being turned in the drill. They are spaced 1/8in. apart, and 1/8in. from the end of the spacer.

Capacitance	Meter Reading
5	7.5
10	14.5
15	20.5
20	25.5
30	34.5
40	43
50	50

A table showing how our meter readings on a 0-50 scale worked out in capacitance readings.

The terminal rings are a single turn of wire twisted firmly into each groove. The twisted ends form the actual terminals and their positions are staggered slightly to minimise the possibility of shorts. A spot of cellulose cement on each will help to keep it firm.

The two spacers are coupled together with a piece of threaded rod (a machine screw with the head cut off) and then screwed on to the threaded portion of the probe, with a solder lug to make connection to the latter.

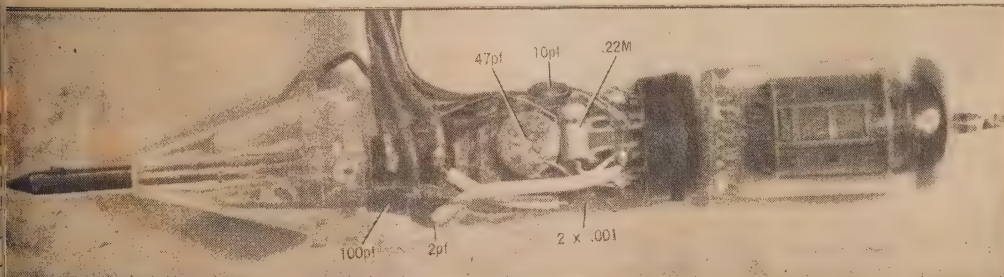
The coil is fitted next, and this calls for some packing between former and spacer. We used a short length of 8mm plastic tubing, which proved to be exactly the right size both inside and outside. The short section of the coil former goes toward the probe.

Before fitting the socket, the latter must be modified slightly. We used a moulded type (Teletone type ST29) and removed the metal mounting plate. In addition, we found it necessary to grind the edge of the moulding slightly to allow it to go inside the probe housing. It is fitted by simply pushing it on to the turned down end of the spacer. The distance from the bottom of the socket (moulding) to the start of the plastic probe should be 1 5/8in.

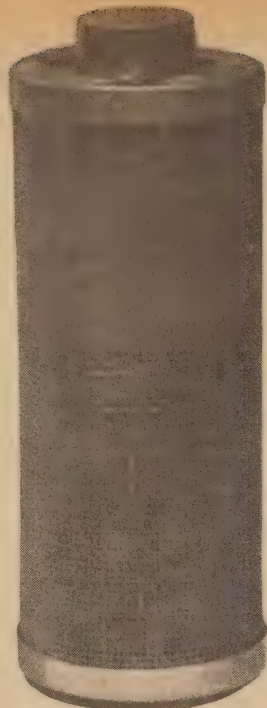
We would have liked to bring the probe cable out the rear end of the probe in the usual way, but there is simply not enough room to pass the cables between the inside wall and the valve envelope. Even if this could be done with very thin wire, it is doubtful whether the insulation would withstand the heat for long.

As a result, we had to bring it in the side near the business end of the probe; an arrangement which is still quite convenient, even though it does not look quite as neat. If a larger probe is employed, this problem can be overcome.

To accommodate the cable it is necessary to cut a small slot in the lower end of the brass housing, being about 1/4in wide and 1/4in long. Some ventilation holes should also be provided in the vicinity of the valve envelope; preferably slightly below it so that a flow



Another view of the probe showing further details.



W. L. Hutt

Complete Audio Equipment
430 Bourke St., Melbourne. MU5032

"360" TWEETER

Absolute Naturalness of Sound

NO PEAK OR BEAM EFFECT.

**THE ONLY ONE OF ITS KIND
IN THE WORLD**

Actual Size 5" x 2"

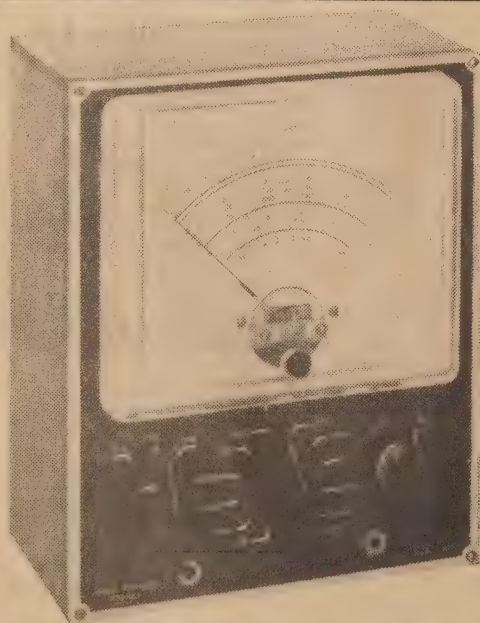
Impedance Tappings of 2, 8, and 15 ohms

PRICE £14/14/-

QUEENSLAND: C. A. Pearce Pty. Ltd.,
43 Bowen St., Brisbane. B5860, B8510

N.S.W.: Audio Engineers Pty. Ltd.,
422-424 Kent St., Sydney. BX6731

NEW ZEALAND: Fred Rothschild & Sons,
79-83 Pretoria St., Lower Hutt. 63-581, 61-698



Descriptive leaflet sent upon request.

20,000 O/v version of KT.1. also available
Unbeatable at £16/-/- plus tax.

THE NEW FERRIER KT.1

This comprehensive, complete 25 range 1,000 O/v Multimeter, comes to you in easy to build kit form. The finished product being an instrument of highest quality, housed in a grey metal case and anodised blue front panel. Outstanding features include switched controls, 4½" sq. meter, easy to read scale, all measurements from two terminals only, precision 1% resistors and Ferrier Inbuilt Quality.

Ranges.

AC/DC volts 0-10, 15, 250, 1000.

DC current. 0.1, 10, 50, 250 mA

AC current 0-1 mA (for use with ext. CT)

Ohms. 0-1K, 10K, 100K, 1000K.

D.B. -10 to +54 db.

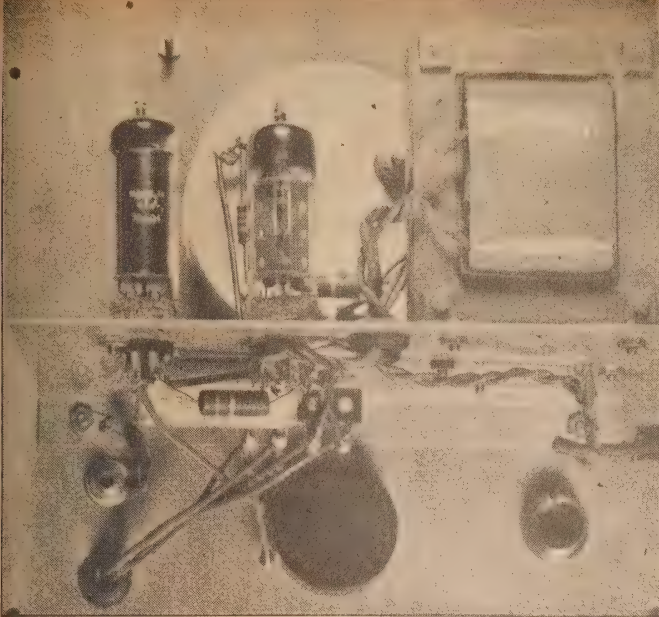
Price only £12

Plus 12½% Sales Tax where applicable. Terms available.

Get yours Now

THYRON RADIO SUPPLIES

233 Victoria Rd., GLADESVILLE, N.S.W.—WX3428



This picture shows how the parts are mounted inside the meter box.

of air can pass over the valve and out the rear end of the probe.

A good idea of the placement of the minor components may be obtained by reference to the coded photographs, and this layout should be followed as closely as possible. The only two resistors used are half watt types, and should also be a type which is insulated, since they can easily touch the inside of the case. If uninsulated types are used, they should be covered with a small piece of paper based insulation tape.

All the capacitors used are ceramic types and it is worth while considering a few points about these. The two most critical ones are the 2 pf and 100 pf forming the voltage divider to the input of the valve voltmeter. The stability of the calibration depends on the stability of these, particularly the 2 pf.

The best unit to use here is what is known as an NPO (Negative-Positive-Zero) zero temperature coefficient type. These are readily available from local manufacturers and, if necessary, a preferred value 1.8 pf can be used. This will increase the sensitivity slightly, necessitating an increase in the meter series resistor value.

Ideally, the 100 pf should also be an NPO type, but these are rather more bulky than can be accommodated in the small probe. The next best is a -750 type (negative temperature coefficient, 750 parts per million, per degree centigrade) and which, in the worst possible case, will cause a drift amounting to only 1 per cent over a temperature range of 20 degrees C. Alternatively, any LOW-K type should be suitable.

In no circumstances should a HI-K type be used in this position.

The 47 pf tuning the oscillator coil is not particularly critical, but a HI-K type should also be avoided here. This is no hardship since there is sufficient

room for the other types. The same remarks apply to the 10 pf oscillator grid coupling capacitor.

The two .001 plate by-passes may be HI-K types, and a single unit, 2 x .001 mfd, is the logical choice.

The power supply and meter are housed in a sloping panel case which is the same as the multimeter case used in last month's multimeter project. However, any other suitable case could be used if already available.

A small chassis is bolted to the front panel and supports the power transformer, rectifier, voltage regulator, and the few minor components. Reference to the photographs will show how these are distributed.

The 1000 ohm sensitivity control in series with the meter is mounted at one end of the chassis, with its shaft facing a hole in the side of the case. It carries a screwdriver slot, making it available for adjustment on the few occasions when this may be necessary. For the most part this will be only when a valve or other component is changed. It is mounted by soldering the pot. cover to a small terminal strip fitted near the power transformer.

The zero control is mounted on the front panel, though even this is not likely to need very much adjustment. Other panel items are an indicator light, an outlet for the probe cable, and a "standard C" terminal.

This latter is simply a good quality capacitor, such as an NPO ceramic, which, with the stray capacitance of the terminal, makes up 50 pf. At any time when it may be desired to check the calibration of the instrument it is only necessary to place the tip of the probe on this terminal and check for full-scale deflection.

(Continued on page 119)

The **RADIOMASTER**

RADIOGRAM CHASSIS...

A great performer on Radio and Records

HI-FI MODEL E22 reproduces perfect high treble notes and bass notes without "drumming" or distortion—brings recorded sound to your home as near as possible to the original. A high gain R.F. stage ensures satisfactory long distance radio reception regardless of location. Features include:—

- Treble and bass boost with separate controls
- Two matched Jensen speakers (12in and 6in) with crossover network.
- Eight valves, world range.
- Push-pull output—inverse feedback.
- Provision for tape recorder.
- Latest type Radiotron valves.
- Custom built — six months' guarantee
- Frequency coverage: 40 to 13,500 cycles.
- Design tested and approved by the Valve Application Division of Amalgamated Wireless (A'sia) Ltd.

PRICE £41/5/-
Magic Eye tuning indicator 30/- extra.
Packing included. Freight extra.
Other Radiomaster Radiogram chassis are available from **£23/5/-**
Write for particulars.

Television chassis from **£121**

RADIOGRAM CABINETS



Many popular designs available including contemporary in natural maple

NEW CABINET MODELS FOR HI-FI CHASSIS incorporate vented speaker enclosures which provide for dual speakers in separate compartments with "woofer" compartment felt lined and draped. First-class finish.

ALL TYPES OF THREE-SPEED RADIOGRAM UNITS

WRITE FOR CATALOGUE

H. B. RADIO PRODUCTS

103-105 Catherine Street,
Leichhardt, SYDNEY.

Telephone: LM5580

Established 25 years.

£££

SAVE ON THESE LINES BIG FEBRUARY BARGAINS

£££

The WARBURTON FRANKI Page

CHECK IT EACH MONTH FOR
ALL YOUR RADIO & TV NEEDS!

● AMPLIFIERS

Well-known English make, complete with Pre-Amplifier Control Box. This unit is rated at 10 watts and features a Radio/Gram/Mic Selector Switch, Top Cut Filter, Record Equaliser, Bass and Treble Controls and Volume Control with A.C. Switch. FEW ONLY to clear at £69/10/-. Usual price £82/19/-. Freight Forward.

● SPEAKER ENCLOSURES

Unpolished, R.J. type, suit 8in Speakers. Few only to clear £9/19/6. Freight Forward.

● RECORD PLAYERS Imported

Imported—well-known Continental make. Features Variable Reluctance Pick-up; Automatic Push-button operation; 3 speed. Few only to clear 38 gns. Freight Forward. Usual price £50/15/-.

● HEADPHONES

Imported—High-Impedance. 37/- pair. Post 1/-.

● GERMANIUM DIODES

GEX00. Suitable Crystal sets etc. 4/11 each. Post free.

● MICROPHONES

Well-known make—High Impedance Ribbon. Few only to clear £7/17/6. Post: Vic. 2/3; Int. 3/8. Usual price £9/2/-.

● PLUGS & SOCKETS

Clix Miniature, Single-Pin connection with earth return. Line to chassis. 3/2 pair. Post and Pack. 4d.

● WIRE STRIPPERS

BIB. Adjustable suit various wires. 6/3 each. Post and Pack. 4d.

Min. L.F. Transformers 455 Kc 13/11 ea.
Min. B.C. Aerial Coils 9/9 ea.

Min. B/C R.F. Coils 9/9 ea.
Min. 455 Kc Oscillator Coils 9/9 ea.

Power Transformers 40mA 240V a side, 35/- ea.
Power Transformers 40mA 225V a side, 35/- ea.
Power Transformers 80mA 385V a side, 59/6 ea.

HIGH QUALITY, LOW PRICED

MULTIMETERS from W.F.

MODEL TK-50

Size: 4 3/4in x 3 1/2in x 1 1/4in.
Model TK-50 is a pocket size individual jack type circuit tester with an insulated panel and steel cabinet.
D.C. Volts: 10 250 500 1000V (1000 ohm/V)
A.C. Volts: 10 250 500 1000V (1000 ohm/V)
D.C. Current: 1/250mA.
Resistance: 10/100 K ohm (By 1.5V internal battery).

Price: £8/19/6

Postage: Vic., 1/10; Int., 3/-.

MODEL TK-70

Size: 5in x 3 1/2in x 1 1/4in.
Model TK-70 is a pocket size rotary switch type circuit tester with an insulated panel and steel cabinet.
D.C. Volts: 10 50 250 500 1000V (2000 ohm/V)
A.C. Volts: 10 50 250 500 1000V (2000 ohm/V)
D.C. Current: 500 uA/25/500mA.
Resistance: 10K ohm/1 Meg. ohm (By 3V internal battery).

Decibels: Minus 20 to plus 22db.
Plus 20 to plus 36 db.

Price: £12/15/-

Postage: Vic., 1/10; Int., 3/-.

MODEL TK-90

Size: 6in x 4in x 2 3/4in.
Model TK-90 is a handy size rotary switch type circuit tester with a black bakelite panel and cabinet, having a high sensitivity 45 uA meter 20,000 ohms per volt on D.C. and 8,000 ohms per volt on A.C.
D.C. Volts: 10 50 250 500 1000V (20,000 ohms/V)
A.C. Volts: 10 50 250 500 1000V (8,000 ohms/V)
D.C. Current: 50 uA/2.5/25/250mA.
Resistance: 5/50/500 K ohm/5Meg ohm (By 3V internal battery).

Decibels: Minus 20 to plus 5 db.
(0db minus 0.75V minus 600 ohm).

Plus 5 to plus 22 db.

Price: £15/15/-

Postage: Vic., 1/10; Int., 3/-.

WARBURTON FRANKI STOCK TEST EQUIPMENT MADE BY—
SANGAMO — WESTON — GENERAL RADIO — MARTINDALE —
PATON — TAYLOR — ADVANCE — TELEQUIPMENT — GOSSEN —
COSSOR — KLEMT — UNIVERSITY

All Test Equipment available on EASY TERMS.

Write for free pamphlet giving details of above.

FOR TOP PERFORMANCE

MAGNAVOX LOUDSPEAKERS

Wide range of types to suit all applications.

TYPE	SIZE	WATTS	FREQUENCY RANGE	PRICE	POST	INT. VIC.
HF5	5in	4	130-10 K.c.p.s.	55/11	1/10	3/-
6 WR	6in	6	30-15 K.c.p.s.	£6/10/-	1/10	3/-
8 WR	8in	7	30-15 K.c.p.s.	£7/1/-	2/3	3/8
12 WR	12in	10	40-15 K.c.p.s.	£7/9/7	2/11	4/4

The Voice Coil Impedances of all the above Speakers are 2.7 ohms. Transformers available to suit—ALL Types from 500 ohms to 14,000 ohms C.T. 30/9 ea. Post. Vic., 1/10; Int., 3/-.

TRANSISTOR CRYSTAL SETS

The most powerful crystal set ever made. Works anywhere—internal battery lasts 6-9 months. Supplied complete with Headphones, Aerial Wire, Insulators, etc. Price: £5/19/6. Postage: Vic., 2/3; Int., 3/8.

MULLARD 5/10 FOUNDATION KITS

Consisting of:

● Main Amplifier Chassis ● Pre-Amp. Box ● Etched Front Panel ● Shields—Brackets ● Hardware—Resistor Strip ● Picture diagram of complete assembly. £8/11/- Freight Forward. Or with Power Transformer and Output Transformer £21/2/3. Freight Forward.

GARRARD 301

Transcription Turntables, 3-speed £46/7/6. Freight Forward.

GARRARD RC88

Record Changers, 4-speed, 32-volt Model, works direct from house lighting plant, £34/2/6. Freight Forward.

For everything in Hi-Fi or Radio and TV Parts, contact W. F. Write or Call for Free Resistor Colour Code Sheet

WARBURTON FRANKI

(MELB.) LTD.

359 LONSDALE ST., MELBOURNE — PHONE MU 9664



OPEN SAT.
MORNINGS

TRADE ALSO
SUPPLIED

PLEASE ADD FREIGHT OR POSTAGE WITH ALL ORDERS

FROM THE -SERVICEMAN WHO TELLS

The question of TV aerials is still with us and it looks as though some of the fallacies will die very hard indeed. It has reached the stage where questions are being asked in Parliament, and I feel bound to add to some of the remarks I made in the December issue.

ACCORDING to a recent newspaper report, the Postmaster-General, in reply to a question in the House of Representatives, stated that outdoor TV aerials were not always necessary for good reception, and suggested that prospective purchasers should obtain technical advice before installing such aerials.

Alternatively, he suggested that buyers should ask for a trial without such an aerial before making a purchase. He went on to say:

"It appears to me that in some instances buyers of TV sets are going into greater cost than necessary to ensure good reception by putting up outside aerials. The buyer should ask for a trial of the set in his area."

GENERAL AGREEMENT

To some extent this is an over-simplification of the case but, while I would disagree on some of the details, I can only commend the statement on general principles.

The first point to clarify, I think, is why people shun outdoor aerials. In some cases it is simply a matter of economy as already suggested, but in others it is more a matter of aesthetics—they just don't want all that ironmongery disfiguring the clean lines of their contemporary architecture.

In these cases the matter of cost hardly affects the problem; they will gladly pay just as much for an indoor aerial if they believe it possesses some magic property that makes it equivalent in performance to an elaborate outdoor type.

It is significant that some of the most elaborate (to look at) indoor aerials cost as much as some of the dearer outdoor types (around £15), the only saving being that one does not have to erect them. My own experience is that their performance is as far from impressive, particularly as they may have to be both orientated and tuned for each channel.

STILL INTERIOR

I have no doubt that the same amount of money spent on buying and erecting the simplest type of outdoor aerial would give at least equal performance, if not a good deal better, as well as being more convenient.

However, that is not the point. These people want an indoor aerial, are prepared to pay for it, and, as usually happens, there is someone ready to oblige them. If they are happy with the results then I suppose that is really all that matters.

Of greater interest is the family of limited means who may be debating whether they can afford TV or not, and will probably have to make a number of sacrifices anyway, in order to pay for it. In this case, the difference between the cost of an elaborate aerial and its erection (which may easily ac-

count for £25) and a cheap pair of rabbit ears with no installation cost, may well be the difference between owning a set and not owning one.

(It may also be remembered that every £1 added to the first cost adds just that much more to the interest which the purchaser has to repay, which can conceivably add 50 per cent to the nominal price of the installation).

As I have remarked before, I am not particularly partial to these simple indoor aerials, if only because they are not securely anchored and, therefore, likely to be moved about at the whim of every member of the household. However, take that same set of rabbit ears and secure properly in a proved position under the roof (assuming it is non-metallic) and the results could be all that may be desired in many locations.

In other words, while the conventional indoor aerial located on top of the set may present special problems, there is no reason why the simplest (and cheapest) type of aerial, mounted under a non-metallic roof, should not prove adequate in a large number of ordinary suburban locations. What is more, it should not cost a fortune to supply or erect.

DO-IT-YOURSELF

In fact, there is no reason why the average handyman with some radio knowledge should not make and erect his own at virtually no cost—which is a good deal better than £25 for some thing which is quite unnecessary.

There seems to be little doubt that many installations are "over-engineered"—to use the expression of one engineer associated with large-scale aerial installation. There is plenty of evidence of this in my own suburb. My own locality is

far from ideal, being well down toward the bottom of a gully, yet I need nothing more elaborate than a simple fan, as do most of those about me.

However, as one progresses toward the top of the hill the aerials become more and more elaborate, until finally, at a spot where the TV towers are clearly visible, there is the most elaborate one of all, the sort of thing intended for near-fringe-area operation.

I would take a lot of convincing that anything like this was really necessary.

But the most amusing one of all is in a nearby suburb. Once again, on top of a hill in clear line of sight to the transmitters, there is a similar style of aerial. Standing high above a luxurious home, it looks most impressive with its array of folded dipoles, reflectors, directors and so forth.

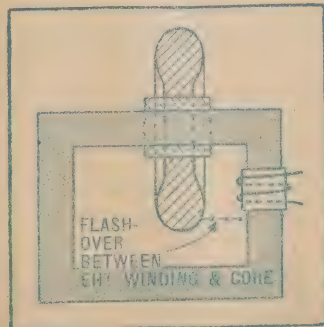
UNUSUAL DIRECTION

There is only one thing wrong. The back of the aerial is facing directly at the station, while the main pickup lobe faces out in the general direction of Gunn's Gully and the Black Stump.

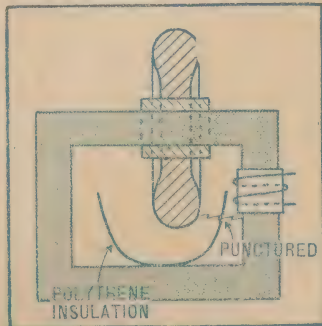
As a well-known comedian would say: 'Yer can't help laughin'! It makes yer laugh!"

Of course, there are plenty of examples of lesser degrees of this. Elaborate aerials at 45 degrees or even broadside on to the station are not unusual, and there seems little doubt that the amount of signal from these aerials proved an embarrassment until they were deliberately mis-directed. But, of course, the customer still pays for an elaborate aerial.

As for the P.M.G.'s suggestion to seek technical advice on this matter; well, I have no doubt that this was offered in all sincerity, but I must add the query, "From whom?"



What we thought happened. A flash-over between the EHT winding and the iron dust core. Its exact position was difficult to determine due to the compact nature of the cage.



The first attempt at a cure. A piece of polythene insulation between the two points concerned. This eventually failed when the spark punched a hole through it.

NEW R.C.S. PRE-ALIGNED TV IF's, COILS and STRIPS

ALL VIDEO and SOUND IF's

in square cans fitted with silver mica condensers. Pre-tested and pre-aligned ensuring satisfactory picture without further alignment.

Comb. Video IF & Soundstrip Part No. 557

Square can mica condensers internal. Combination video. IF sound strip consisting of 5 video IF's, 2 sound IF's and one ratio detector, mounted on comb. cadmium chassis. Socket holes punched for 8X6 valves.

£5/15/- plus tax

Comb. Video IF & Soundstrip Part No. 556

Square Can — mica condensers internal. Combination Video — IF Sound Strip consists of 4 video IF's, 2 sound IF's and 1 ratio detector mounted on combination cadmium chassis. Holes punched for 6AC7 valves. Wound in R. and H. specifications.

£5/10/- plus tax

3-CHANNEL TUNER Part No. 1553

1 Cadmium Bracket, all holes punched.
1 Video Coupling Transformer.
1 2-Bank by 3-Position Switch with 6 Coils mounted.
1 Concentric Fine Tuner Control Circuit.

£3/13/4 plus tax

New Square can IF's with internal condensers

Part	
112 First video 6AC7	14/-
113 Second video 6AC7	14/-
114 Third video 6AC7	14/-
115 Fourth video 6AC7	14/-
101 Tuner coupling	14/-
102 First video. 6BX6	14/-
103 Second video 6BX6	14/-
104 Third video. 6BX6	14/-
105 Fourth video 6BX6	14/-
106 Fifth video. 6BX6	10/-
107 First Sound bifilar	11/6
110 First C.T. Sound	10/6
108 Second Sound bifilar	11/6
111 Second Sound pri. and sec	13/6
109 Third Sound ratio detector	18/-

Coil Former $\frac{3}{4}$ " square can with two cores

Part No.	
506 4-pin coil assembly	4/3
507 4-lug coil assembly inc. 2-47pf	7/4
508 5-lug ratio assembly inc. 1-22pf and 1-47pf	7/4

Video and RF choke, filament and filter chokes

Part No.	
408 Aer. RF choke. C.T. 2uh	3/4
409 2uh filament choke	3/4
410 15uh video choke	3/4
441 47uh video choke	3/4
412 150uh video choke	3/4
413 330uh video choke	3/4
414 TV noise filter, 2amp	3/4
415 3uh damper diode choke	3/4

(Trade price subject to sales tax)

R.C.S. RADIO PTY. LTD.

651 FOREST RD., BEXLEY, N.S.W. LW3491-5385

SOLE FACTORY REPRESENTATIVE — VICTORIA

Distributors Corporation Pty. Ltd.,

403 Bourke Street, Melbourne. MU3908.

FILTER CHOKES AND TRANSFORMERS

Part No.	
55 power transformers	6.3v 20
56 power transformers	12v 20
1.5 amp	20
60 filter choke 100m.a. 30h	15
66 filter choke 14h 60m.a.	10
80 2-5v 1.75 amp. 6 kv ins.	26
61 4v 1 amp. 5kv ins.	26
62 6.3v .6 amp. 5 kv ins.	26
63 frame output trans. 6BM8	33
220 EHT supply 3000v. Osc. coil	26
77 3h. 300m.a.	20
78 1h 300m.a.	20
534 Coil dope and core sealing lacquer	3

NOISE SUPPRESSION

Part No.	Aerial Filter Kit	Price
19	1/2amp Line Filter	47
20	3/4amp Line Filter	53
26	3/4amp Line Filter with condensers	53
22	2amp Line Filter with condensers	50
24	2amp Line Filter	56
27	2amp Line Filter with condensers	65

Above prices are Retail Prices and inclusive of Sales Tax.

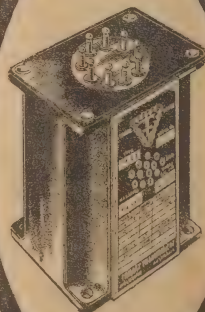


TRIMAX IS WAY AHEAD IN RELIABILITY PERFORMANCE & QUALITY!

Choose TRIMAX because exhaustive technical research, modern methods of manufacture and rigid performance tests guarantee you a thoroughly reliable product

OUR RANGE INCLUDES:

- IGNITION Transformers
- POWER Transformers
- AUDIO Transformers
- CURRENT Transformers
- AUDIO Amplifiers
- POWER Amplifiers
- IGNITION COILS
- POWER & AUDIO CHOKES
- ELECTRICAL CONNECTORS
- MICROPHONE STANDS
- TEST EQUIPMENT
- TV & RADIO Protective Metal Work, etc.
- SOLENOIDS



TRIMAX TRANSFORMERS PTY. LTD

AGENTS IN ALL STATES

CNR. WILLIAMS RD. & CHARLES ST., NORTH COBURG, VIC. Phone FL1203

Readers may remember the story I related in the December issue concerning a customer who was worried about the adverse effect of an indoor aerial on a TV set. I thought that was an isolated case, but I have encountered two more such cases since then, which could be traced (in a general way) to two widely different suburbs.

One of these approached me directly, the other put the same question to a colleague, in whose word I have the utmost faith. Both had been told by dealers that an indoor aerial would, to use my own customer's expression, "... drag the inside out the set in a few months." (Only he didn't say "inside.")

In the face of all this, I can only assume that some recognised dealers are either not very well informed — or not very honest.

Which makes it rather hard for a prospective buyer to know whether any such advice he may seek is really worth anything or not.

BACK TO THE BENCH

My first technical story this month comes from a colleague who, while not a professional serviceman, is a very keen and experienced radio enthusiast. The story concerns his own TV set, an imported commercial model, and which developed a fault which kept him guessing for several months. Naturally, the final triumph of man over machine was the occasion of much rejoicing.

Over this period I saw him only at odd intervals, at which times he gave me the latest bulletin on his troubles and went on his way to try something new, either at my suggestion or on his own initiative. It was only when the problem was finally solved that I was able to put all these scraps of information together and make a coherent story.

As I say, the trouble started several months ago and was in the form of spasmodic flash-overs in the EHT system. At odd intervals there would be a resounding "splat," the picture would roll momentarily, and the viewers would be startled out of their wits.

At first this happened only occasionally, and my colleague was inclined to blame deposits of dust and weather conditions, and contented himself with dusting the picture tube around the ulior contact and blowing some air through the cage.

TEMPORARY RESPIRE

This seemed to cure the trouble for a while and, when it did re-appear, my friend simply assumed that the same treatment would suffice. However, the trouble became more frequent and he soon realised that there must be a more serious cause.

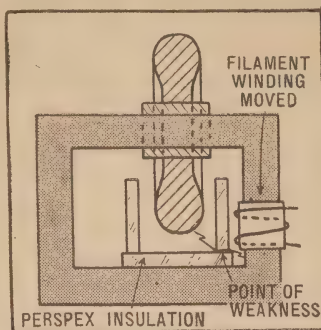
One of the hardest things about troubles of this kind is to localise them. For one thing, their erratic nature makes it unlikely that they will occur when the set is under observation; after all, there is a limit to the amount of time one can spend staring fixedly at the EHT cage.

But even when one's vigil is rewarded, it is still often extremely difficult to pin-point the exact spot at which the flashover is occurring; partly because most EHT cages are pretty well packed with parts, and partly because no one is ever anxious to get his nose too close to the inside of this device while it is working.

Nevertheless, my friend did finally

track it down. By a rare combination of luck and persistence he was able to observe a spark jump from the EHT winding to the iron dust core on which it was wound. (See figure 1.)

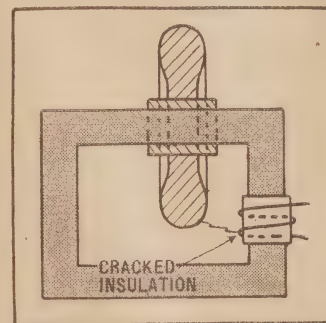
This immediately raised the question as to whether the trouble was due to a



The second attempt. Heavy Perspex insulation was fitted, but failed at the point where parts were cemented. The filament winding was inadvertently moved, thus worsening the situation.

circuit fault or a fundamental weakness in this particular design. Although rather hesitant to accept the latter theory, he was forced to admit that there did not seem to be any circuit fault which could cause it. In particular, the EHT voltage appeared to be quite normal.

There was also the question of what to do about it. There was not much point in replacing the EHT transformer if, in fact, it was an obscure circuit fault but, on the other hand, this might be the only way to prove the point



What really happened. A crack in the filament winding insulation allowed this point to flashover to the EHT winding during the negative swing, the potential difference then being in excess of the EHT voltage.

In view of all these problems my friend finally decided on an essentially practical — if somewhat negative — approach to the problem. He would simply improve the insulation around that part of the winding, thus at least curing the effect. If some other fault were present there was a reasonable chance that it would eventually reveal itself in some other manner.

Accordingly, he obtained a piece of semi-circular polythene (actually, por-

tion of a discarded flexible plastic drinking cup) and mounted it around the portion of the winding in the manner shown. (Figure 2). He reasoned that the polythene would be so much better than the air, that it should cure what was, after all, a marginal condition.

For a while it seemed that he had succeeded. In fact, several months went by without a sign of the trouble and my friend was convinced that it had been a weakness of design and that the extra insulation was really needed. Then, one night—"splat"; and it was on again.

An examination of the cage revealed a rather remarkable condition: The spark had punched a neat hole clean through the polythene insulation; thereby suggesting that it was of more than usual intensity. But how and why was the question my friend still had to answer.

MORE INGENUITY

Still convinced that more insulation was required between these two points, and being possessed of a certain stubborn streak, my friend's next move was ingenious, if somewhat unconventional.

He built himself a small U-shaped framework of heavy gauge perspex, held together with perspex cement made in the approved manner, and fitted this into place around the EHT winding. (See fig. 3).

By all the laws of the game this should have been more than enough insulation, but my friend had overlooked one point. Being rather impatient to try his brainchild he turned the set on before the cement had had time to dry properly: whereupon the spark immediately found this weak spot and shot straight through it. Apparently the insulating properties of the solvent used in the cement were poor compared with the perspex itself.

However, what really worried him was the fact that the entire fault had now become much worse; so much so, that it was now obvious that a definite fault of some kind existed, and that it was time to come to grips with it.

All the work up to this point had been done without disturbing the EHT cage appreciably, both the polythene and perspex insulators having been fitted by sliding them between other components on the end of a pair of long-nose pliers. Thus it had not been possible to examine the EHT transformer in detail.

INSIDE THE CAGE

My friend had decided that the time had come for this to be done. He found that by slackening off a couple of mounting bolts and unsoldering a couple of connections he was able to swing the transformer around into a position where he could examine it in greater detail.

He checked it carefully and found nothing suspicious until he came to the EHT rectifier filament winding. This consisted of the usual couple of turns of heavily insulated wire around the iron dust core, located directly opposite the EHT winding.

But what really caught his eye was a longitudinal crack in the polythene insulation, exposing the bare wire for about a quarter of an inch. In addition, this was on the side closest to the EHT winding. Could this be the cause of the trouble and, if so, how did it fit in with the symptoms already observed?

My friend had to admit that these things seemed to contradict each other

290 LONSDALE STREET, MELBOURNE — FB3711

COLLARO-TRANSCRIPTION TAPE RECORDER DECK

£52/19/6

LANCO-GOLDRING 4 Speed Transcription TURNTABLES

£30/-/-

TV AERIALS

Model 11	£6 1 0
Model 111	£8 5 0
Model 212	£9 10 0
Model 215	£12 5 0
Model 313 super fan	£9 6 0
Model 300 Rabbit Ears	£4 15 0
"The Showman" De-luxe model indoor antenna	
£15/10/0	300 Ohm balanced twin feeder lines
£1 per yard	All types of TV insulators stocked.
TV Lightning Arrestors	16/3 ea.

TV PARTS

E.H.T. Transformers 17in or 21in.	£27/8/6
21in Deflection Coil assy.	£27/8/6
17in and 21in Linearity Coil with Ferrite Rod	£14/4/0
17in or 21in Line and E.H.T. Chassis assy. Complete	£23/17/6
Ferrocart TV Turret Tuner.	£23/17/6
Miniwave Philips turret tuner.	£18/5/6
Q plus Mk1 IF strip	£27/2/6
Q plus Mk11 IF strip (with limiter)	£31

ALUMINIUM CHASSIS BLANK: T.C.R.

5 x 3	8/1
6 x 4	9/1
8 x 5 1/2	12/3
10 x 6 1/2	14/8
13 x 8 1/2	21/9
11 x 8 1/2	17/6
13 x 10 1/2	21/0
17 x 8 1/2	27/0
17 x 10 1/2	30/7
17 x 12 1/2	32/7

FILTER CHOKES

C8/1 14H/60mA	22/9
C5/1 20H/100mA	44/1
C3/1 20H/100mA	39/6
C1/3 20H/125mA	76/6
C1/1 20H/150mA	92/10
C6/1 20H/200mA	126/0

17" BRAND NEW TV PICTURE TUBES (REJECTS)

ONLY 19 Gns.

CAPACITORS

Ceramic HI-KI Disc. (Subminiature)	
22 pf. — 400 pf.	2/1
401 pf. — 10,000 pf.	2/5
Ducon TV Capacitors	
500 pF/15KV	34/6
50 pF/350V	21/6
50 MFD/350V	24/3
100 MFD/350V	19/9
U.C.C. Special "Dectroflash" MFD. 250V W	46/7
Ducon Paper Capacitors	
.001-.006 600 Volt	1/2
.01 600	1/6
.02 600	1/5
.03 600	1/6
.05 200	1/2
.05/400	1/4
.05/600	1/7

1/200	1/2
1/400	1/2
1/600	2/-
25/200	2/-
25/400	2/5
25/600	2/11
5/200	2/7
5/400	3/11
5/600	4/1

Variable Tuning Capacitors	
A.W.A. Miniature (12-450 mmfd.)	28/6
2 gang	37/6
3 gang	40/3
A.W.A. Standard (11-430 mmfd.)	39/6
1 gang	22/-
2 gang	23/3
3 gang	29/6
Robian Midget type	21/-
1 gang	33/6
2 gang with Vernier	40/3
3 gang plain	43/9
3 gang with Vernier	50/2
Label 7-plate	32/2
Label compression trimmers	1/6
Philips Air trimmers (3-30 pf.)	4/6
M.S.P. Air trimmers (2-28 pf.)	4/6

NOISE SUPPRESSORS	
Ducon P.N. 351 1 x 1/240V AC/600V DC	15/4
Ducon P.N. 426 for Remington Razor	7/9
Ducon P.N. 435 (Mikmaster type)	7/9
Ducon P.N.T. 380 Auto generated suppressor	1/2
R.E.S. CV40 100mmfd. reaction variable capacitors	17/3

RECORD PLAYERS & RECORD CHANGERS	
B.S.R. HF 8 4-speed player.	£13/5/6
Collaro 3-speed record player.	£13
Dual model "295" 4-speed record player	£18/10/6
Collaro 4-speed record changer.	£12/7/6
B.S.R. 4-speed record changer.	£20/10/6
Philips 3-speed record changer.	£25/18/6
Dual 100 L/1 automatic record changer, 4-speed	£32/8/6
Philips AG 201 "Disc Jockey" in portable case	£21

PICK UPS:—

Goldring L.56 Transcription arm	£21/5/6
Goldring L.56 P/U with variable reluctance cartridge.	£3/12/5
Acos HGP 40 P/U with 2 heads.	£9/15/6
Acos HGP 50 P/U turn over.	£4/19/6
Acos HGP 60 P/U (Ceramic).	£6/16/6
Ibbott crystal P/U 2 heads.	£14/10/6
Ronette crystal P/U 12in or 16in arm	£7/10/6
Garrard P/U needle pressure gauge	£1/5/-

MICROPHONES:

Acos M.I.C. 35 crystal hand micro phone	£2/15/-
Acos M.I.C. 22 crystal hand micro phone	£3/18/6
Zephyr 3XA crystal microphone.	£6/7/6
Zephyr 4XA crystal microphone.	£6/7/6
Zephyr 8XA crystal microphone.	£7/14/3
Zephyr 1XA microphone insert.	£2/5/9
Acos Mic. 19 microphone insert.	£5/5/6
Acos Mic. 32 microphone insert.	£2/15/6
Zephyr 6ft extension microphone	£5/6/6
Zephyr Adjustable banquet hand.	£4/10/6
Zephyr 9in desk type minitransd.	£6/2/6

Zephyr 6in desk type minitransd.	20/6
Zephyr Oval 4in desk stand with press to take switch	£5/9/9
Zephyr 50 ohm to arid oval case line type mic. transformer.	£4/1/9
Zephyr 50 ohm to arid chassis mounting type mic transformer.	£3/12/6
Zephyr Cord type chromium plated fully shielded transformer	22/6
Type L.B.I. plain	26/6
Type L.B.I. with 3 P. switch.	32/6
L.T. 53 Westinghouse 6/12V and battery charger rectifiers	70/-
Servisol 1/2-pint tins	9/-

SOLDERING IRONS

Scope "6 seconds" soldering iron.	50/-
Transformer for same for 230V operation	22/6
Birco D.9 40 watts. 3/16in bit.	34/9
Birco D.8 60 watts. 3/8in bit.	40/3
Birco D.1 80 watts. 1/2in bit.	47/6
Erkin Multicore solder 40 tin	12/6 1lb reel
Erkin Multicore solder 60 tin	14/- 1lb reel
Coraline 2oz tin soldering paste.	2/9
15 Ohm. Woofer-Tweeter Comb.	£6/6/6
A.W.A. 20928 12in Woofer	£6/6/6
A.W.A. 20766 6in Tweeter	£2/9/6

ROLA LOUDSPEAKERS

1C	£12 10
4C	£11 6
4H	£12 10
4SC	£17 6
4SF	£2 8
SCX	£18 0
5F	£2 6
5FH	£2 5
5FL	£3 6
6H	£2 5
6H	£18 6
6H	£15 0
6-9L	£3 9 6
NH	£10 0
8L	£12 6
8M	£3 0
8-PA	£3 3 0
12K	£3 6 0
12-0K	£4 1 0
12-0	£6 0 0
12-0 Deluxe	£6 10 0
12Lx Hi-Fi 15 ohm V.C.	£28 19 6

Ironcore Transformers

All prices subject to sales tax plus 25 p.c.

15/14 30 mA/150 V/6.3	33/-
13/22 40 mA/285 V/6.3 5V	41/10
13/16 40 mA/385 V/6.3 5V	46/2
15/102 50 mA/225 V/6.3 V	39/7
17/4 60 mA/285 V/6.3 V 5V 46/2	
17/18 60 mA/285 V/6.3 V 5V 55/2	
17/1 80 mA/285 V/2 x 6.3 V	55/2
17/20 80 mA/385 V/2 x 6.3 V	61/7
16/18 100 mA/285 V/2 x 6.3 V	61/7
16/26 100 mA/385 V/2 x 6.3 V	66/7
16/20 125 mA/285 V/2 x 6.3 V	66/7
16/28 125 mA/385 V/2 x 6.3 V	74/10
16/22 150 mA/285 V/2 x 6.3 V	79/2
16/24 200 mA/285 V/2 x 6.3 V	191/2
16/32 200 mA/385 V/2 x 6.3 V	114/5

EXTRA SPECIAL

Genuine Connoisseur Mk1 P-ups with Diamond Head.

£12/10/- ea.

HI-FIDELITY ELECTROSTATIC TWEETERS AVAILABLE NOW PRICE ON APPLICATION

Special Offer in H.F. 15in World Famous Bass Speaker 25 CS/sec, 15 ohm V.C. 30 GNS.

OKA ROTARY WAVE CHANGE SWITCHES

1 x 11 x 1	11/10
1 x 11 x 2	18/4
1 x 11 x 3	25/7
1 x 12 x 1	13/10
1 x 12 x 2	23/10
1 x 12 x 3	31/4
2 x 4 x 3	24/10
2 x 5 x 1	11/7
2 x 5 x 2	17/10
2 x 5 x 3	24/10
3 x 1 x 1	11/7
3 x 1 x 2	17/10
3 x 1 x 3	24/10
4 x 2 x 1	11/7
4 x 2 x 2	17/10
4 x 2 x 3	24/10
6 x 2 x 1	23/10
6 x 2 x 3	31/4

RECORDING TAPE

BASF 1200 7in reels	67/6
BASF 1200 7in reels	65/-
Collaro Hi-Fi 1200 7in reels.	70/6
Philips 1200 7in reels	95/-
Scotch 1000 5in reels	28
Scotch 600 5in reels	45
Scotch 1200 7in reels	70/6
Westinghouse 1200 7in reels.	62/-

RADIO PARTS BARGAIN

18, 20, 22, 24, 26, 28, 30, 33 B and S Wire. 40z Reels	10/6
12 SK7 Valves	5/-
12 SK7	5/-
12SK7 Valves	5/-
12 L Valves	5/-
15 x 7 x 2 1/2 Aluminium Chassis	10/-
25,400 paper capacitors	1/6
1in Ca. octal	35/4
.0005 Mica Capacitors. doz.	5/6
Little General Chassis	5/6
Porter Portable Chassis	5/6
Fireside-free Chassis	7/6
5-pin Plugs with covers	doz. 6/-
25,600 paper capacitors	1/6
Spin Ceramic Sockets	1/-
15A6 Valves	5/-
Assorted Knobs. doz.	3/-
1in Synch. Vibrators	£10/10/6
New 3-speed players	£10/10/6
Rola 12 MX Twin cone Speaker	£6/16/6
Brown moving coil Mic. in sets	39/6
5-valve Black crackle finish chassis	9/11
7 valve Black crackle finish chassis	11/6
6 chassis	10/6

SOCKET PUNCHES

(Hammer or screw type)

1-3/16 STD	43/4
1in Ca. octal	35/4
3/4in Inoval	30/3
5/8in button cone	23/3
1in for pots, bezels, etc.	23/3
"BIB" wire strippers	6/9

Call in and see our Mr. M. S. Hurrey. Let him solve your HI-FI problems for you! We are Suppliers of LEAK, QUAD, WHARFEDALE, ORTOFON, FERROGRAPH (etc.; etc.) equipment.

in fact, his early observations were correct. But were they? To be sure, he had seen a spark in this general vicinity but, due to limited visibility, he couldn't be really sure that it had been between the EHT winding and he core. More correctly he had merely assumed that this was so because one naturally assumes that any flash-over will originate in the EHT winding.

Now that this theory was suspect, what was the alternative based on the damaged filament winding? Might it now be reasonable to suppose that the spark jumped between the filament winding and the EHT winding, rather than between the EHT winding and chassis? (Fig. 4.)

One's first reaction to such a suggestion is that this is unlikely because both windings are at the same potential; around 15,000 volts with respect to chassis. But this is only true of the EHT winding for that brief period of time when the outer end reaches its peak positive condition; at all other times it is less than this and for part of the cycle actually swings in the negative direction.

STORAGE ACTION

The filament winding, on the other hand, does remain at essentially this voltage, being held there by the storage action of the EHT filter capacitor. This means that, assuming a peak voltage of 15,000 and a sine wave voltage in the EHT winding (it won't be, but let's skip that for the moment) there would be a potential difference of 30,000 volts between the filament and EHT winding, at the moment the latter was at its maximum negative swing.

This is what we call the Peak Inverse Voltage, and is always quoted in rectifier data sheets. The reason is fairly obvious; the rectifier has to withstand this voltage between plate and cathode every time the supply winding presents the reversed polarity.

Admittedly the wave form in this case is far from a sine wave, but it could still add several thousand volts to the 15,000 stored in the filter capacitor, making a nice little insulation problem.

Of course, this is so with any set and is one reason why the insulation of the filament winding is normally so thick. In this case the cracked covering had reduced the insulation from that of polythene to that of air. Air is not only a relatively poor insulator—compared with our modern plastics—but also a very variable one, depending on temperature, barometric pressure, humidity, etc. Not much wonder that it broke down on odd occasions.

WINDING MOVED

Examination of the transformer also revealed a possible reason why the trouble had become so much worse after the attempt to fit the Perspex insulation. In the fitting of this material it seemed quite likely that the position of the filament winding had been moved slightly, sliding it down the leg of the core to a position where the distance between the damaged insulation and the EHT winding was significantly decreased.

As is so often the case, the cure was relatively simple. Being unable to buy a grade of wire exactly the same my friend striped down a length of co-axial cable, removing the outer covering and the braid, and used that for a new filament winding. In addition, he applied liberal layers of high quality plastic insulation tape to both the core and the outside of the winding. He was

determined it would not occur again.

All running tests to date, extending over several weeks, have failed to reveal a trace of the old trouble, and he is confident that it is cured.

Assuming that it is, I think the moral of this story is plain. It is all too easy to fall into the trap of false or incomplete observation, and to fill in the gaps with assumption, eventually leading to completely wrong conclusion.

If you're an amateur, such false trails can be extremely frustrating but if you're a professional serviceman, they can be mighty expensive.

ANOTHER FALLACY

And to round things off I must relate another rather amusing fallacy I encountered a few days ago. I had dropped in to wish a colleague the usual good wishes for the festive season, and was introduced to one of his neighbours—a newcomer to this country from the United Kingdom.

My colleague had just finished building himself the RT & H TV set, so it was natural that the conversation should turn to this subject. With justifiable pride he demonstrated the set's performance, and it was generally agreed that it was quite equal to the average commercial model.

The only complaint came from his wife, who objected to the naked chassis sitting on top of a discarded cabinet in her otherwise neat lounge room. My colleague laughed. "That's the next job on the list," he admitted, "but I want to work out a design that will allow the speaker to mount in the front. I'm not keen on this side mounting idea."

I was on the point of agreeing when my English friend spoke up. (I wish I could reproduce his accent in print.) "Oh I don't think I'd put it in front. They always put them in the side in the old country. It's supposed to give better tone that way. Cuts out all that vibration."

In fairness to our friend I should point out that he is not a radio man and knows only what he has been told by salesmen. I have not the slightest doubt that he made the statement in all sincerity, but I would certainly like to know how that rumour started.

Was it a product of the English TV trade in an effort to justify this ob-

viously convenient method of speaker mounting? (Our Australian counterpart hasn't thought of THAT one yet!) Or was it a genuine result of expressed public opinion away from high fidelity reproduction—a sort of acoustic "tone control."

As a matter of fact, there may be some basis for the latter theory. From other remarks our friend made I gathered that he was one of those who had not yet come to accept faithful reproduction, but preferred the so-called "mellow tone." "That vibration" to which he referred was apparently any form of high note reproduction.

If he is an average English listener (and viewer) it may well be that this prejudice has been put to good use by English manufacturers, enabling them to satisfy the average taste and retain a simple TV cabinet at the same time.

Anyway, whatever the cause, it is an interesting commentary on fashions in other countries.

BBC Continues Tests With Colour TV

ALTHOUGH there are no regular services in Britain for colour TV, engineers have been working continuously to develop a suitable system. In 1956 numerous transmissions were made during tests and demonstrations, but these were not intended for the public.

A second series of such test transmissions of colour television are being undertaken by the B.B.C. This new series of experimental transmissions, which began in October and will continue for about six months, are being radiated from the B.B.C.'s Crystal Palace station (Channel 1) outside the normal program times.

The purpose of the tests is:

- (1) To provide a source of high-grade colour picture signals so as to permit colour receiver development work to continue,
- (2) To enable further experience to be gained in the operation of the colour studio and colour transmitting equipment, and
- (3) To obtain further knowledge of the compatibility provided by the particular system of colour transmission being tested.





→ **ODDMENTS**

SALE

* PARTS

* BASES

* CASTINGS

* DOMES

* COMPLETE LAMPS

* REFLECTORS

* FLEXIBLE TUBES

* CANOPIES

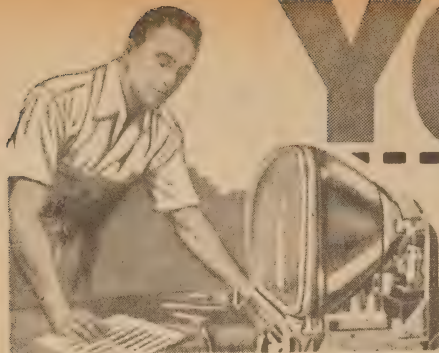
* LAMP HOLDERS

Mr. Handyman! Make up your own ultra-modern fittings **CHEAPLY!** Most items less than half price!

SPECIAL LIGHT FITTINGS

2 ROYAL ARCADE, SYDNEY. MA 5018
(Off George St., just opposite Queen Victoria Building)

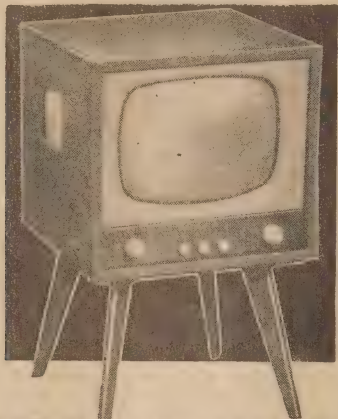
PTY.
LTD.



YOU CAN

**Yes, you save money
make money when you
build an E.P. kit set**

NOW . . . 17in or 21in TV KIT!



CABINET NOW AVAILABLE

Yes! We can supply a craftsman-built version of the "R. TV. and H." cabinet (17in. and 21in.) in walnut or maple

SPECIAL PARTS NOW IN STOCK

Ready-drilled TV receiver chassis with 3 brackets and E.H.T. box
Cadmium plated . . . £3/12/6
Set of 10 A.W.A. Deflection Components, 17in model . . . £12/11/8
Set of 10 A.W.A. Deflection Components, 21in model . . . £14/0/2
Ready-drilled cadmium-plated chassis for I.F. strip . . . 19/6
Power Transformer to R.T.V. and H. specifications . . . £6/18/-
Filter choke . . . £1/15/-
The A.W.A. 17 HP1B is the correct 17in picture tube . . . £30/14/-
The A.W.A. 21 ALP4 is the correct 21in picture tube . . . £41/0/-
Picture masks and picture tube sockets available ex stock.
(POSTAGE EXTRA ON ABOVE PRICES.)
IMPORTANT! Before buying any individual components for your TV Set, investigate Electronic Parts price for the kit—complete or in sections—it's amazingly low.

TRADE ALSO SUPPLIED

**Send for details NOW
TO ELECTRONIC PARTS PTY. LTD.**

Dear Sirs,

Please forward descriptive list of the TV Kit Sets

NAME

ADDRESS

Both the 17" and 21" R.T.V. & H. Television sets are winners. We have built them and can testify that picture clarity is better than the most, and equal to the best commercial sets. These outstanding designs offer the hobbyist a remarkable opportunity to make a first-class TV set at extremely low cost. A parts for both 17" and 21" models now available.

Complete Kit available

The E.P. kit is complete with all necessary high grade materials right down to the last nut and bolt. Write, phone or call for descriptive price list. Everything as specified by "R.T.V. & H."

- To spread the cost, the kit may be purchased in four constructional stages described in "R.T.V. & H."
 - Laboratory checking and alignment service available.
 - Working models on view at our premises.
- Yes, not only can you check your assembly and wiring against our master model, but if you wish we will check and align your completed T.V. set.

It's easy with an E.P. Kit

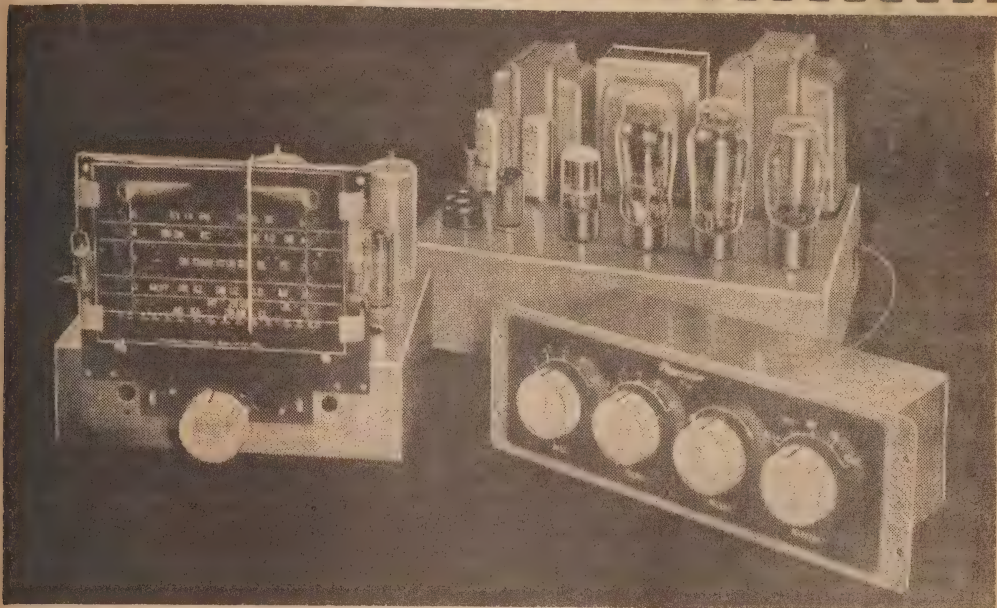
- Ready-drilled chassis, including brackets, E.H.T. box, etc., all cadmium plated, and passivated.
- All special mechanical parts included—i.e. knobs, bushes, pot-shafts, pot-brushes etc.
- Designed to use "R.T.V. & H." tuner kit or ready-built commercial tuners

ELECTRONIC

THE T.V. KIT SET SPECIALISTS

**E. S. & A. BANK BUILDING
(opp. Grace Bros.)
Corner Broadway & City Rd., Sydney.
Phone: BA4891-2-3**

BUILD IT YOURSELF!



Build your own Hi-Fi outfit!

PLAYMASTER

HIGH FIDELITY AMPLIFIERS TUNERS CONTROL UNITS

Designed by "Radio, Television and Hobbies" this high-grade equipment offers combinations of units to suit every requirement. Quality of reproduction on performance and figures is amazing. Furthermore, the cost is much lower than that of similar powered imported units. If you prefer to build your own hi-fi gear, we can supply the kit of parts containing precisely the same high-grade components as are used in the completely built unit.

The range includes high quality amplifiers from 20 watts to 5 watts, control units, and a complete range of tuners (including the latest F.M. tuner). You are invited to write, phone or call for illustrated descriptive catalogue.

SPECIAL!

A COMPLETE HIGH-GRADE

PLAYMASTER OUTFIT FOR UNDER **£50**

If you are keen to obtain hi-fidelity reproduction, something much better than could be expected from even the more expensive radiograms, this genuine hi-fi outfit will appeal to you. It comprises Playmaster 5/6 watt-amplifier (available as a kit or completely built), the sensational Magnavox 12 WR twin cone speaker and latest Dual record player. Operated from a suitably designed cabinet, it gives truly superior quality reproduction of your recordings. Send now for Playmaster catalogue.

PARTS Pty. Ltd.

THE HI-FI SPECIALISTS

E. S. & A. BANK BUILDING

(opp. Grace Bros.)

Corner of Broadway & City Rd.,

Sydney, N.S.W. PHONE BA4893

**Send for details NOW
TO ELECTRONIC PARTS PTY. LTD.**

Dear Sirs.

Please mail me your free catalogue describing Playmaster Hi-Fi equipment.

NAME _____

ADDRESS _____



Here's your answer, Tom!

Once again Tom has put pen to paper in order to find a solution to a number of problems that have been plaguing him. From the volume and nature of his queries we must imagine that he has spent many sleepless nights. In fact, the repetition of his first query leaves us somewhat out of breath.

What are Ignitrons, Magnetrons, Klystrons, Image Orthicons?

Phew! Quite a mouthful for a boy, Tom! We shall have to take them one at a time, however, and attempt to enlighten you without becoming too involved.

Ignitron is a term of American origin and describes a mercury arc rectifier, which like the mercury vapour rectifier possesses an automatic starting facility. It also has the heavy current capacity of an ordinary arc rectifier.

In the ordinary mercury-arc rectifier, a considerable process has to be gone through before the arc is struck and, consequently, before it conducts. In the Ignitron, rectification begins at once.

The automatic action is accomplished by placing an igniting electrode in contact with a mercury pool at the bottom of the evacuated bulb. An anode is placed above the mercury pool. Current flowing through the igniting electrode and the surface of the mercury creates a small spark. This spark develops into an arc at the application of a suitable potential to the anode at the time the spark is struck.

The igniting electrode is made of a suitable refractory material and, once the arc is established, the ignition circuit opens, thus saving the power that would be necessary to maintain the arc.

A magnetron is a diode in which the path of electrons is determined by the resultant forces on them of a magnetic field produced externally and an electric field produced internally.

The resultant action of the two fields produces a third field which tends to make the electrons move orbitally around the cylindrical cathode. If the fields are equal, the electrons have a circular or radial motion so that some tend to reach the anode which is generally an outer cylinder.

The magnetic field remains constant while the electric field may be varied by changing the anode voltage. Lowering the anode voltage and thus weakening the electric field tends to make the electrons move more in a circular manner and prevents them from reaching the anode. Increasing the anode voltage, on the other hand, has the opposite effect.

The cylindrical anode magnetron is little used in its simplest form, but developments of the basic principle have a great importance in the application of centimetric waves.

The klystron is another valve which finds an application in the generation of centimetric waves. This valve is used

either as an amplifier or a generator of centimetric waves.

Its action is such that the electron stream is made to form into bunches by the use of a cavity resonator. The valve comprises an oscillator whose feedback arrangement is formed by interconnecting two cavities through a tube. The cavities are known as the buncher and the catcher. The catcher is also the anode and is earthed.

The cathode is biased negatively with respect to the anode and electrons are accelerated toward the buncher, opening which acts as a grid in controlling the electron stream. The action of the buncher is to accelerate and repel, in turn, the electrons arriving from the cathode so that bursts of electron flow arrive at the mouth of the catcher.

The bunched electron beam passing through the mouth of the catcher excites the



"Come on—it's your turn to be the program."

cavity resonator into oscillation and, because of the interconnection between the two cavities, there is constant feedback of energy and, hence regeneration like that of any oscillator.

The "Image Orthicon" is one of the most advanced designs of television camera tube yet evolved. Similar tubes are manufactured under other trade names and are employed almost universally in full-sized TV cameras.

Electrically this tube consists of three distinct sections, an image compartment, a scanning section and electron multiplier.

Light rays are focused, by means of a lens, on to a transparent photo-cathode and electron emission takes place from the inner surface of this cathode. An accelerator grid, having a positive potential, accelerates these electrons away from the photo-cathode and causes them to strike a glass mosaic at great velocity.

This second mosaic is a film of glass having so fine a structure that the charges which accumulate on it can be influenced by electrons from an electron gun at the rear.

The rear of this mosaic is scanned by a low velocity beam from the electron gun and a cancellation of positive charges present at the rear surface of the mosaic, occurs.

The remaining electrons double back on their path and return to the structure surrounding the gun. This structure is actually a photo multiplier structure which greatly amplifies the variations in the electron current returning from the mosaic.

★ ★ ★
In the TV IF strip which you described in your magazine, sharp cut-off pentodes such as the 6AC7 are employed. Now, if the incoming signal is fairly strong and the AGC system functions by increasing bias to these tubes, why do they not have their operating points shifted to some position giving non-linear operation?

I would suppose that variable-mu tubes were necessary when employing a method of gain control which relies on altering the bias of the tube under control.

I know that there must be a simple answer because the system works but, it seems that you could only control the gain of a sharp cut-off tube within narrow limits and still retain linear operation.

The solution to your problem is not simple but is a matter of compromise.

High Gm tubes are really essential to obtain adequate gain and bandpass. However, variable-mu types are likely to produce more noise than sharp cut-off types because of their higher drain. As a result, there is a general preference for sharp cut-off high-Gm types.

Because of the use of these tubes, some difficulty is actually experienced with automatic gain control, but it isn't as bad as it may appear.

AGC is applied to at least two stages, often three, and this distributes the control function. Furthermore, the plates and screens of these stages are usually

fed through dropping resistors or at least the screens are.

Any increase in bias is thus offset to an extent by the increase in screen voltage, which produces a less sharp cut-off than might otherwise be expected.

By carefully proportioning the amount of AGC voltage fed to the IF stages and striking suitable operating conditions, adequate control can be obtained without obvious non-linear distortion. But there isn't much to spare, Tom!

★ ★ ★

What are Henries?

Henries are practical units of inductance, having convenient magnitude for the rating of inductors. A Henry is defined as the amount of inductance necessary to set up a back-e.m.f. of 1 volt when the current through it is changing at the rate of 1 ampere per second.

The Henry is a large unit of inductance and is used for the rating of large inductors with iron cores. For smaller inductors such as tuning coils and RF chokes, the millihenry (abbreviated mH) and the microhenry (abbreviated μ H) are used.

The millihenry represents a thousandth part of a henry while the microhenry represents a millionth part of a henry.

★ ★ ★

What are the advantages of a loop-aerial and must a variable capacitor be used with one?

Loop aeriels have two distinctive properties. The first is their directivity which is put to good use in direction-finding equipment, particularly for small ships.

Secondly, even though relatively small, they can intercept radio signals reasonably well and therefore find wide use in portable radio receivers. In general, the ability of a loop to intercept signals increases with its size, but practical loops in even large portable sets are not as efficient as a good outdoor aerial and earth. Compactness and convenience are their strong points.

Over the past few years, loop aeriels have been displaced from favour in portable receivers by ferrite rod aeriels, which are as good if not better in regard to signal pickup, but easier to make and to instal in a cabinet.

A loop or a ferrite rod aerial can be regarded as a tuning coil which is large enough to intercept signals. As such, it must have the right inductance and must be tuned to resonance for the incoming signal by a variable capacitor.

In other words, Tom, a capacitor is just as necessary with a loop or ferrite rod as with a conventional aerial coil.

★ ★ ★

What is delayed AGC?

Delayed AGC is an automatic gain control which does not come into action unless the incoming signal exceeds a certain predetermined amplitude.

This is accomplished by applying a small negative voltage to the anode of the rectifying diode or an equivalent positive voltage on the cathode. Weak signals are thus subjected to the full gain of the R.F. or I.F. amplifiers, and are not subjected to unnecessary gain reduction by the AGC system.

Delayed AVC is the same thing as delayed AGC, the latter term gaining preference these days because it is more universal in sense.

★ ★ ★

I have frequently seen the word "earthy" used in some of your articles to describe sections of wiring and components. What does this imply?

The term earthy is used to describe a circuit point which has the least impedance or the smaller of two impedances to earth. In other words it implies that this circuit point is not likely to vary in potential anything like as much as another which is part of the same circuit, and which may carry definite signal potentials.

In the majority of cases a direct earth connection is implied. For example one end of a grid leak resistor may be connected to an earth and is referred to as the earthy end. Should this resistor be returned to the cathode, the cathode end would still be referred to as the earthy end, since the cathode is at or near earth potential with reference to the grid and is the point of lower impedance.

Points along the AVC or AGC line, or even on the B-plus line, might be described as "earthy" as far as signal voltages are concerned. Even though such points are not directly earthed, they are most likely bypassed to earth (or chassis).

In other words, Tom, use of the word earthy is a verbal short-cut which is very handy when describing circuits or wiring.

★ ★ ★

What is the difference between a series and a shunt motor?

The basic difference between a series and a shunt motor is in the method of connecting the windings of the field magnets.

In the case of a shunt motor the field windings are connected in parallel with the armature and receive the full supply voltage. In the series motor, as its name implies, the field windings are connected in series with the armature.

The operating characteristics of each of the motors are quite different. As the field winding of the shunt motor is connected across the mains, the strength of the field is not affected by the load on the motor, except for a demagnetising effect which is caused by the current in the armature conductors and which has greater influence as the load increases. Unloaded, the motor runs at a fixed speed which falls slightly as the load is increased.

In the series motor the fixed current depends upon the load on the machine and, since the speed is inversely proportional to the field strength, the motor runs more slowly on heavy loads and increases speed on lighter loads.

If this type of motor were allowed to run without a load, it could develop a dangerous speed. It is therefore only used in cases where a permanent load is present, sufficient to restrict its speed to a safe, if rather high, figure.

A series motor is not a good choice where the load is likely to vary or where constant speed is important.

High FIDELITY

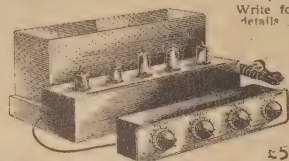


AEGIS

Fidelity Tuner Mark 2

Latest model Companion for Aegis Amplifier Satin-sold finish

£32/17/6
Write for full details today.



AEGIS

Mullard "S-10" HI-FI AMPLIFIER

A reliable hi-fidelity Amplifier made in Australia for our conditions. Write for leaflet.

AEGIS MFG. CO. PTY. LTD.

208 Lt. Lonsdale Street, Melb., FB3731

ASK TO SEE THEM BOTH AT YOUR DEALER'S.

AWA

RONETTE

MICROPHONES & ACCESSORIES

Type C53

£4/19/-



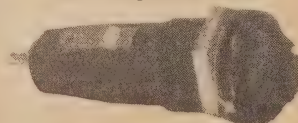
Hand or stand mounting. Omnidirectional. black plastic housing and hand grip. Ideal for tape recorders and similar applications.

NEWTON McLAREN LTD.

17 LEIGH ST. ADELAIDE

FUSE HOLDERS'S

Front loading panel mounting



Also Panel Lights—Neon Indicators—Knobs

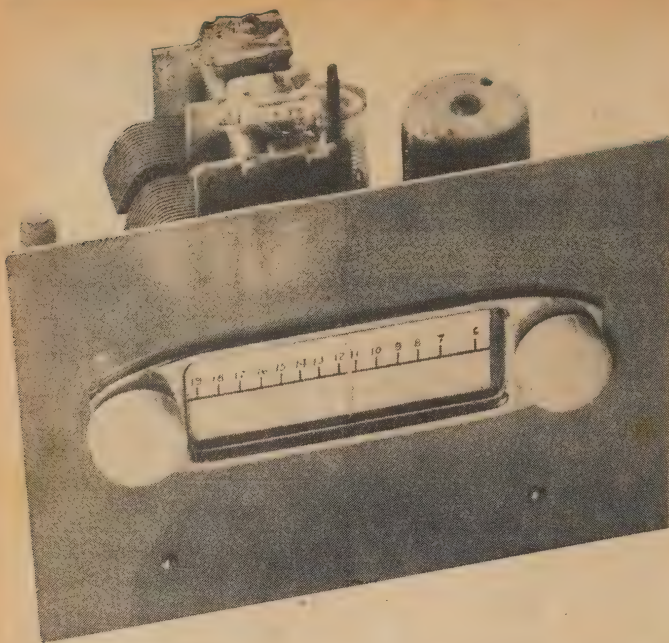
Manufactured by
AMPLIFIER COMPANY OF AUSTRALIA
85 Asling St., Gardenvale, S.4. Melb
Phone XM1472
Associated with Wilson's Radio Service

PIEZOELECTRIC CRYSTALS

Maxwell Howden

15 Claremont Crescent,
Canterbury, Victoria

Prices on receipt of full specifications



The completed converter ready to be connected to a broadcast receiver. Only two controls are required; the tuning control is on the left while the broadcast /short wave change-over switch is on the right. In the broadcast position the switch also breaks the filament supply to the valve.

Short-Wave Converter For Battery Sets

Here for the first time we are describing a battery short-wave converter using the miniature 1R5 converter valve. It is compact, simple to build and adds little to the total current drain. Its use with a good quality portable, for instance, will enable you to hear all available stations on the normal short wave channels.

WHILST we have described a number of mains operated shortwave converters in recent years, we have become aware that there is a large proportion of country readers relying on battery operated receivers for their source of entertainment who are also interested in shortwaves.

In some districts, reception on the broadcast band may be extremely difficult and sometimes impossible, forcing listeners to turn to the shortwaves, particularly the A.B.C. outlets near 6 Mc. These are continuously on the air and reception from them is very much worthwhile.

The popularity of shortwave listening

is also appreciably affected by the large influx of people from the continent, who, like to keep in touch with the events at home.

Such people are widely scattered, and

by
Wes Yashin

could easily comprise the major section of enthusiasts.

Although battery operated receivers in the home are far less in number than they were some years ago, there has been a very great increase in the number of portable sets manufactured and sold. They would undoubtedly represent the majority of such sets in use.

In general, the performance of a modern portable is extremely high, and coupled to this converter, one popular portable showed very good sensitivity.

One can well visualise a case in which a portable set used some distance from the city on a holiday jaunt may give poor direct reception of National stations, but good strength on a shortwave channel with far less static. This is a state of affairs which we have encountered ourselves.

PERFORMANCE REQUIRED

Realising this we set out to produce a unit capable of meeting all but the most difficult of requirements for good short-wave listening.

When connected to a broadcast set, it does in fact convert it into a double change shortwave superhet of considerable sensitivity.

In keeping with simple design we have dispensed with an RF stage and concentrated on a single band. Reception is however good enough to pick up everything worth hearing, while the coverage is equal to that of the ordinary dual wave receiver.

Most important shortwave stations today use high power and directional aerials, so that their regional transmissions are invariably strong and easily receivable.

The construction of this unit should not be beyond the scope of the average constructor and even the beginner, as we have laid it out to make the best of its modest parts list.

The average dual-wave receiver on the market today must make a compromise between acceptable results on the broadcast and shortwave bands.

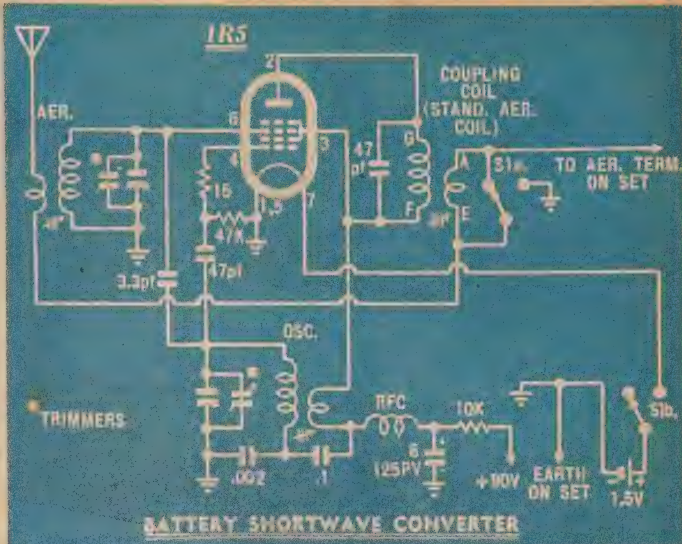
In order to achieve reasonable selectivity and bandwidth on the broadcast band, an intermediate frequency of 455

Kc is conventional. This however, poses a problem on the shortwave band, in the form of image interference. Because the offending signal will be only twice the intermediate frequency away from the wanted station, the tuned circuit or circuits ahead of the converter are rarely selective enough to eliminate the interfering signal completely.

The best solution to image interference, while retaining selectivity and sensitivity, is the double change superhet. That is what the whole setup becomes when we couple a converter to a broadcast receiver.

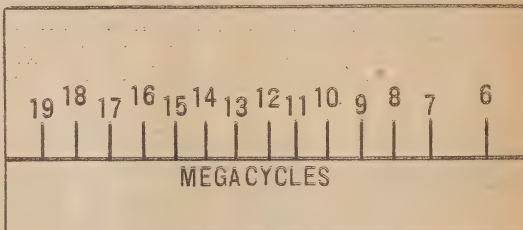
In the double change superhet the in-

CIRCUIT DIAGRAM OF CONVERTER



The circuit is straightforward, being virtually the front end of a standard battery receiver. The slight variations are there to ensure stable operation of the converter over the entire band.

For the guidance of those likely to experience difficulty in calibrating the converter, a copy of the original scale is reproduced. Note that the calibration points are quite evenly spaced.



coming signal is first changed to a relatively high IF, generally between 2 and 5 Mc. This change contributes little to the overall sensitivity, its prime purpose being to place the image frequency far enough away for the pre-selection stage to reject it.

A second change then takes place; this time to a conventional IF which favours gain and selectivity.

Our converter produces a high first IF and, when coupled to a broadcast receiver having a 455 Kc. IF the advantages of a double-change principle become evident.

CHOICE OF IF.

A short-wave converter in its simplest form consists of a converter valve, and associated coils, tuned to receive one of the short-wave bands. Instead of providing the conventional IF of 455 Kc., it supplies a frequency somewhere in the tuning range of the broadcast receiver to which it is coupled. The actual figure we used is around 1,600 Kc.

Although in our converter we are not able to make the first IF any higher than 1,600 Kc., it is still a worthwhile improvement in image rejection since it places the image 3.2 Mc. away.

This is adequate to greatly improve the image rejection, as the tuning circuits concerned can discriminate much more effectively between signals spaced so far apart.

In addition the converter valve in the unit will contribute something to the overall gain, thereby improving sensitivity as compared with a conventional receiver.

The circuit we used is not unusual, being virtually the converter stage of an ordinary battery receiver. Any variations from the usual are mainly precautions to keep the IR5 oscillating reliably over the full range of the short-wave band.

NEUTRALISATION

Due to the structural arrangement of the electrodes within the IR5, the capacitance between them causes portion of the developed oscillator voltage to be fed back to the signal grid, tending to produce "pulling" and loss of gain on the shortwave band.

This problem is overcome by a form of neutralisation whereby a portion of the out-of-phase voltage at the oscillator grid is fed back through a small capacitor to the signal grid.

The value of capacitor selected helps to maintain a steady grid current over the entire band.

In order to increase grid current with-

out loss of frequency coverage, the well-known scheme of padder feedback is used.

Looking at the circuit, you will see that .1 mfd. bypass capacitor from the B plus end of the oscillator feedback winding is returned to earth through the padder capacitor.

To enable this arrangement to function, an impedance which is high in comparison with the reactance of the bypass capacitor at radio frequencies is

inserted between it and the B plus line. This impedance is represented by the R.F. choke.

To prevent oscillator flutter caused by audio feed via the B plus line, an electrolytic capacitor is connected between the R.F. choke and the dropping resistor.

A final precaution to ensure smooth operation of the oscillator is the 15 ohm resistor in series with the oscillator grid, which, in conjunction with decreased values of the grid capacitor and resistor, guards against possible "squegging" in the oscillator section.

MECHANICAL

The components used in this unit are quite standard and readily available through the normal channels. The dial is a small type, as used in our Karset. Although a shortwave glass is not available for this dial, it is a relatively simple matter to make up a suitable scale on a piece of card and paste this on the inside face of the dial behind the pointer. The calibrations may be inked in, and the glass, without the existing calibrations, may be replaced.

As a guide for those who may find calibrations difficult, we are reproducing

PARTS LIST

- 1 Chassis 6in. x 4 1/2in. x 1 1/2in.
- 1 Panel 7in. x 5in.
- 1 2-gang tuning capacitor.
- 1 MSL/48 dial.
- 1 2-pole, 2-position switch.
- 1 Standard broadcast coil.
- 2 3/4in. grooved coil formers with mounting bases and iron cores.
- 1 Miniature 7-pin socket.
- 1 RF choke.
- 1 IR5.
- 1 8 mfd 125 volt electrolytic.

- 1 .1 mfd 200 volt paper.
- 1 .002 mfd mica.
- 2 47 pf mica or ceramic.
- 1 3.3 pf mica or ceramic.
- RESISTORS
- 1 47K 1/2 watt.
- 1 10K 1/2 watt.
- 1 15 ohms 1/2 watt.

SUNDRIES

- 1 terminal, 2 knobs, 1 8-tag terminal strip, 1 2-tag terminal strip, coil winding wire, nuts and bolts, hookup wire, solder, solder lugs and scrap metal for battery bracket.

RADIO COMPONENTS

UNIVERSITY KITS



MULTIMETER KIT MK1 (illus.)
You can assemble a professional instrument in a few hours. A sensitive 0.5 mA meter with all parts for 18 different ranges. Includes instructions, case, etc.

£13/10/-

PLUS POSTAGE

OSCILLATOR KIT OK1.
Companion unit to above, covers I.F., B.C., and S.W. ranges

£13/10/-

PLUS POSTAGE

MAIL ORDERS

YOUR MAIL ORDER WILL RECEIVE PROMPT ATTENTION

Standard stock lines are despatched by return mail.

Please add postage to your remittance.

PRICE'S RADIO

NAME PLATES AND SCALES

The following plates are nickel plated on back
VOLUME CONTROL SCALE (as illustrated). Graduated 0-10 through 330 degrees.
Size 2 1/4 in x 1 3/4 in.
As above but 1 3/4 in x 1 3/4 in.
CONDENSER SCALE. Graduated 0-100 through 180 degrees. Size 1 3/4 in x 1 3/4 in.
As above but 2 in dia.
NAME PLATES. Size 1 1/2 in x 1/4 in.

Following titles:
AERIAL: ATTENUATOR: AC-DC:
ADJUST: AMPLITUDE: AMPLIFIER: BASS: BROADCAST: BAND SPREAD: COURSE: EXTERNAL: FINE: FOCUS: GAIN: HIGH: INPUT: INTERNAL: INTENSITY: LOW: MODULATION: MILLIAMPS: METER: MICROPHONE: OSCILLATOR: OHMS: OUTPUT: OFF-ON: PHONES: POWER: PLAY BACK: PICKUP: REGENERATION: RECEIVE: RECORD: RADIO: SHORT WAVE: SPEAKER: SWEEP: SYNC: SELECTOR: REBLE: TUNER: TAPE: TONE: VOLUME: VERNIER: WAVE CHANGE: X SHIFT: X AMP: X PLATE: Y SHIFT: Y AMP: Y PLATE: 240VAC: 50 c/s.

1/9

each



6d. each

SPEAKER BOXES—



HURRY— ONLY A FEW LEFT

Heavy gauge metal case originally supplied with a car radio, but ideal for extension speakers or permanent installations such as call systems, etc. Size 6 1/2 in x 6 1/2 in x 4 in. Drilled for 6 in MSP speakers. Two-tone Grey and Blue baked hammerstone finish.

4/6

5-6 Angel Place, Sydney

HEADPHONES



OMEGA. Imported lightweight 4000 ohms headset of good quality.

42/- POST 1/3

BROWN Type "F." Feather-weight, 4000 ohms professional headset for those who want quality.

90/- POST 1/3

T.V. COMPONENTS

We have them all—

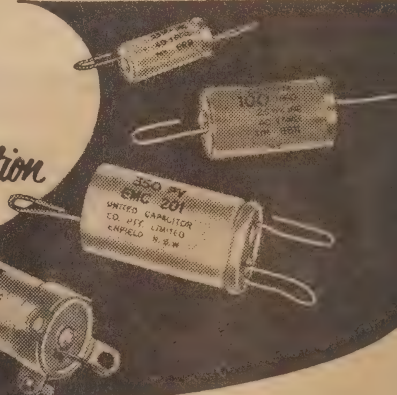
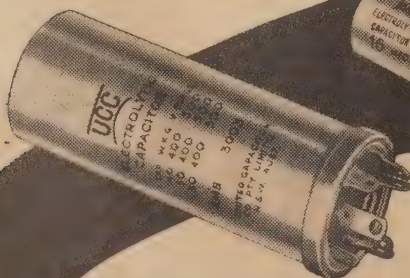
A.W.A., MULLARD, R.C.S., AEGIS, Q-PLUS, ETC.



Electrolytic Capacitors

for every application

for Communications—Radio—Television
THE BEST ELECTROLYTIC YOU CAN BUY.



Check these advantages and specify U.C.C. Electrolytics for your equipment—

- ✓ All aluminium, non-corrosive, internal construction
- ✓ Full hermetic sealing
- ✓ Pure high gain etched foil and paper winding
- ✓ Separate negative tag eliminates open circuits
- ✓ Small size with adequate ripple ratings
- ✓ P.V.C. sleeving on all insulated types.

For further information contact
UNITED CAPACITOR CO. PTY. LTD.—433 PUNCHBOWL RD., ENFIELD—YB 0311
MELBOURNE: U.C.C. Pty. Limited, 486 Bourke Street.
ADELAIDE: Stephen & Co., 83 Grenfell Street.
BRISBANE: Tecnico Ltd., 103 Albert Street.
PERTH: O. F. Gamble, 384 Murray Street.
TAS.: G. A. W. Wood, 46 Brisbane Street, Launceston.
N.Z.: H. W. Clarke (N.Z.) Ltd., 42 Cable Street, Wellington.

REAR VIEW OF THE CONVERTER

a full-sized scale of our own calibrations.

The coils are hand wound on grooved polystyrene formers, to which adjustable cores are fitted. No difficulty should be encountered in the purchase of winding wire and, in any case, the fact that the spacing of the turns is determined by the grooving of the formers, makes the gauge of wire not very critical.

We designed the coils to cover the 16 to 50 metre band (19 to 6 Mc) which may now be considered as the standard. The coupling coil is a standard aerial coil working backward. The secondary becomes the plate winding, while the primary connects to the primary of the aerial coil in the set to which the converter is coupled.

OUTPUT COIL

The new primary in the plate circuit is made to resonate at 1,600 Kc by a capacitor of about 47 pf, the actual value not being critical since considerable adjustment is possible with the metal core of the coil.

One section of a two-pole 2-position switch is employed to make and break the filament supply to the IR5 valve while the other section effects the changeover from broadcast to short waves.

The chassis we used is identical with that intended for a mains operated converter featured recently. Ours was made from 16 gauge aluminium, but 18 gauge should do. A drawing showing the appropriate cutouts is reproduced with this article.

Mounting of the components should present no problems. The dial mounts in its normal upside down position which places the drive spindle on the left-hand side, while the changeover switch is placed in the vacant hole on the right side.

Check the dial stringing for backlash and other mechanical defects which could make for difficult tuning. When mounting the dial drum on to the gang spindle do not omit to remove the drum retaining screw, which is a temporary arrangement used to retain the stringing.

LAYOUT

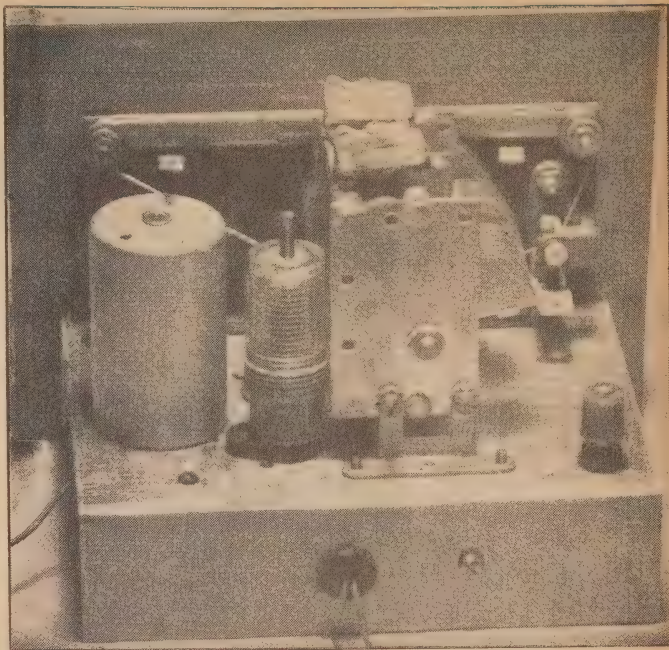
The oscillator coil and the IR5 valve are in line on one side of the gang. The coupling coil is nearer the edge of the chassis between these two components. The aerial coil is mounted under the chassis by the end opposite the base.

A torch battery for the valve filament supply is mounted under the chassis by means of a bracket bent up from scrap aluminium. We felt that a separate filament supply was the best approach to avoid possible interference to possible series filament networks in receivers with which the converter may be used.

You may dispense with the extra battery only if you have established that the receiver has parallel connected filaments, and that the connection of an extra filament is not likely to interfere with the filament network.

The valve socket is mounted with the gap in the pins facing the corner occupied by the changeover switch. Most of the smaller components are supported by a 2-lug strip mounted at the valve socket and an 8-lug strip near the rear edge of the chassis.

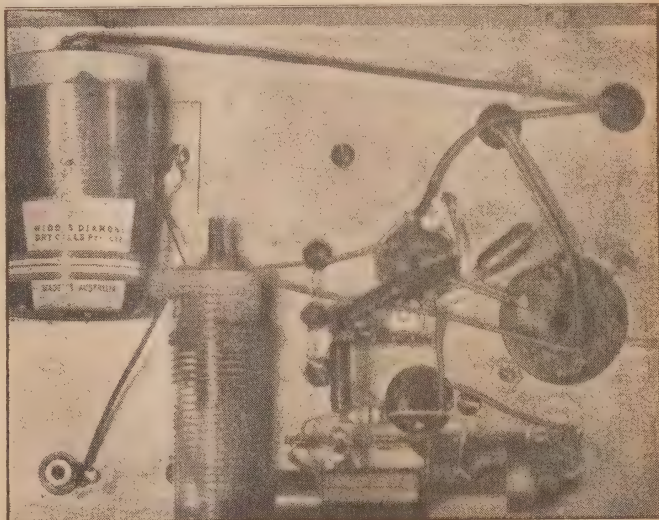
Use is made of the 2-lug strip to support the oscillator grid leak, the oscillator



A rear view showing the layout of the major components. The oscillator coil may be seen alongside the tuning capacitor while the converter valve is in line directly behind it. The output coupling coil is to the left of these.

grid capacitor and the 15 ohms series resistor.

Looking at the 8-lug strip over the front edge of the chassis, lug 1 is the



This under-chassis photograph clearly indicates the placement of the minor components. Wiring details are also visible. The aerial coil is held by a screw through a threaded hole in the top of the former. The oscillator coil is held by a screw through a threaded hole in the base of the former.

Solve your **SWITCHING** problems with

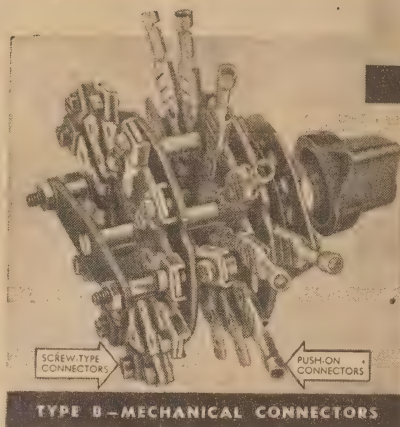


ROTARY 10 AMP. SWITCHES

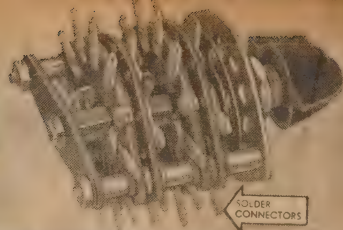
FEATURES:

- Heavy current capacity (10 A.- 250 V. A.C.).
- Small Dimensions.
- Extremely Versatile (Multiple decks 12 contacts 1-4 Poles per deck).
- Single hole mounting.
- Low Price — Long Life — Quick Delivery.
- Manufacturers Note: We can design switches specially for your requirements which reduce wiring time and soldered joints by the incorporation of internal links, also switches with leads attached.

PRICES AND ORDERING
CHARTS ON APPLICATION
TO—



TYPE B—MECHANICAL CONNECTORS



TYPE A—SOLDERED CONNECTORS

NOW BEING FITTED TO:—

Electrical space heaters, Radiators, Transformers, Washing Machines, Lamps, Air-conditioning equipment, Fans, Mixing jugs, Tape Recorders, Battery chargers, Cinema equipment, etc., etc.

REPRESENTATIVES:

MELBOURNE: R. G. Holloway, 299 Little Lonsdale St. BRISBANE: K. H. Dore & Sons, 465 Adelaide St. ADELAIDE: Newton McLaren Ltd., 17-23 Leigh St. PERTH: Carlyle & Co. Ltd., 915-917 Hay St. TASMANIA: Gebbie Harvey Pty. Ltd., 76 Wellington St. LAUNCESTON, NEW ZEALAND: Carrel & Carrel Ltd., 41 Shortland St. AUCKLAND

PATON ELECTRICAL PTY. LTD.

90-94 Victoria Street, ASHFIELD, N.S.W.—UA0381 (5 lines)

NEW FERGUSON FILTER CHOKES



FERGUSON announce the release of a new series of small economical filter chokes for use in radio and T.V. sets, amplifiers, etc.

These new chokes are fitted with robust

cadmium plated steel wrap-over brackets firmly crimped to the core. They are thoroughly impregnated, and fitted with solidly anchored connection leads.

Type Number	Ind. Henries	Current D.C.M.A.	D.C.Resis. Ohms	Dimensions—inches			Mounting Centres	Approx. Weight
				Height	Width	Length		
F14-60	14	60	550	1- $\frac{3}{8}$	1- $\frac{3}{8}$	2- $\frac{1}{8}$	2- $\frac{1}{8}$	14 oz
F6-100	6	100	210	1- $\frac{3}{8}$	1- $\frac{3}{8}$	2- $\frac{1}{8}$	2- $\frac{1}{8}$	14 oz
F12-100	12	100	265	2- $\frac{1}{4}$	2- $\frac{1}{4}$	2- $\frac{1}{8}$	3- $\frac{1}{8}$	2 lb.
F1-285	1	285	48	1- $\frac{3}{8}$	1- $\frac{3}{8}$	2- $\frac{1}{8}$	2- $\frac{1}{8}$	14 oz
F1-325	1	325	27	2- $\frac{1}{4}$	2- $\frac{1}{4}$	2- $\frac{1}{8}$	3- $\frac{1}{8}$	2 lb.

AVAILABLE FROM ALL LEADING SUPPLIERS

Manufactured by

FERGUSON TRANSFORMERS PTY. LTD., CHATSWOOD, N.S.W.

feed point for the oscillator high tension. It supports one end of the RF choke, the .1 mfd bypass and the B-plus end of the oscillator coil primary.

Lug 2 is an earth lug, while lug 3 is not used. Lug 4 supports the remaining end of the RF choke, the hot end of the electrolytic and one end of the 10 K decoupling resistor. The fifth lug is a junction point for the padder, the .1 mfd bypass and the earthy end of the oscillator coil secondary.

The sixth lug is not used, while the seventh is an earth point. The final lug is a B-plus point and supports the incoming B-plus lead, as well as one end of the 10 K decoupling resistor.

Referring to the circuit diagram, you will note that only a B-plus lead is indicated, the B-minus connection being made through the earth return circuit. In no circumstances should a B-minus lead be connected to the set as well as an earth lead, since this will short out the bias arrangement in the set.

COIL WINDING

A word about coil-winding should complete the constructional details. We used bare tinned copper wire for the secondaries, and light, PVC-covered hookup wire for the primaries. The same tinned copper wire could possibly be used for both windings if the primary is encased in spaghetti tubing. Other wires, such as the enamel-covered variety, may also be used. The main reason for having the primary winding wire encased is to facilitate interwinding of the two.

The coils are wound on the lower end of the formers so that the cores are able to clear the winding when fully in. The aerial circuit is quite broad and no difficulty should be experienced in the adjustment of the aerial core.

The oscillator coil will peak with the slug in the almost "out" position, and should difficulty be experienced with insufficient core travel, the winding may be shifted higher, or, alternately, the slug may be reinserted from the top of the former.

Each winding end on the coils should be made long enough to reach directly to its appropriate connection in the circuit. These leads are brought out through four equally spaced holes in the mounting bases attached to the coil formers.

On completion the unit may be connected to a receiver and given a trial run. A service oscillator, although not essential, will be a great help in establishing the correct tuning range.

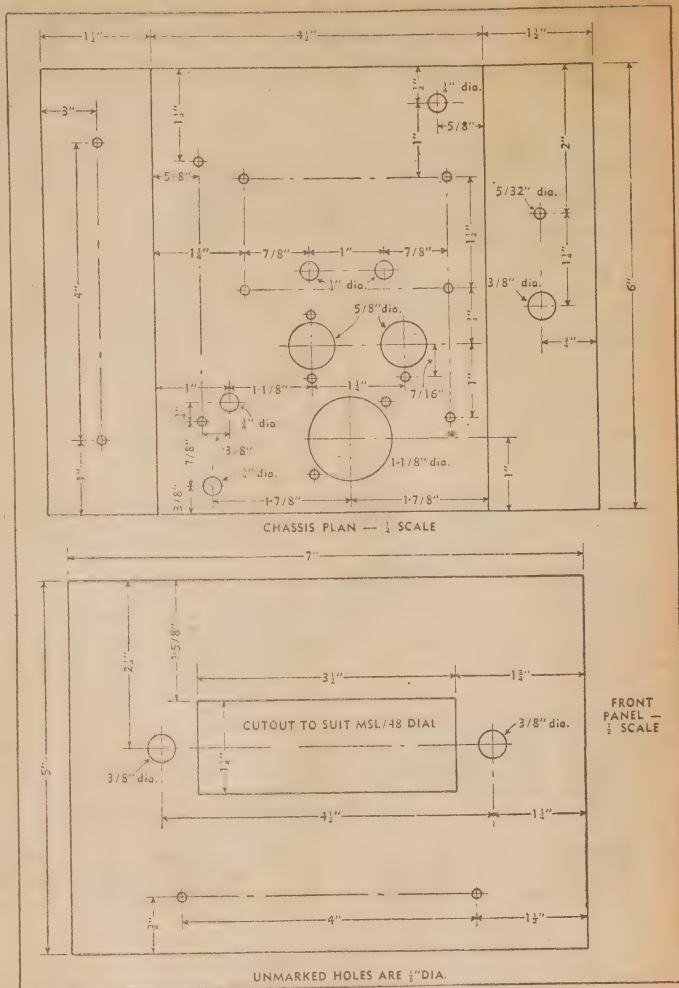
FINAL ALIGNMENT

Set the slugs and the trimmers in about mid-positions. Tune the receiver to about 1,600 Kc and adjust the core of the coupling coil for maximum noise level. Choose a spot on the receiver dial where there are no broadcast signals to mix with the shortwave signals. Also do not place the converter directly beside the receiver, a separation of one or two feet being desirable to prevent the picking up of harmonics from the receiver's local oscillator.

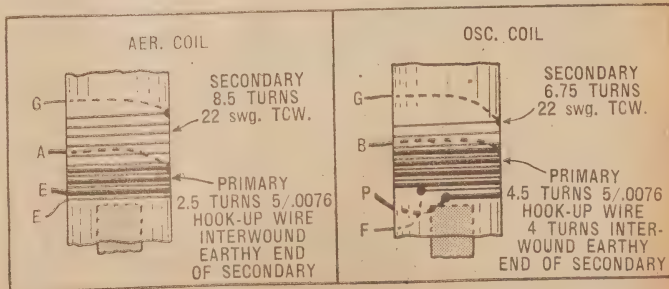
Next tune the converter to a spot near the low frequency end of the band, until a strong signal is heard (or produce a suitable signal with a generator). The aerial coil should be adjusted for a peak and, if one cannot be found, it may be necessary to reset the oscillator slug.

Adopt a similar procedure for the high frequency end of the band, this time peaking the aerial trimmer. Again

DIAGRAM FOR CHASSIS AND PANEL



The chassis and panel are quite easily made using ordinary metal working tools as found in the average workshop. The material used may be either 16 or 18 gauge aluminium and the chassis made without ends in the interests of simplicity. The dial escutcheon may be used as a template when cutting the dial cutout.

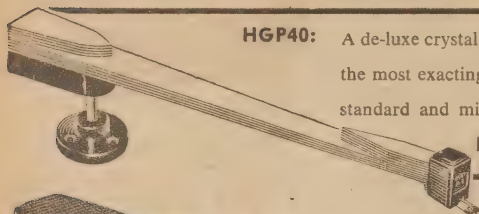


All the essential coil winding data is given in these diagrams. Variations are possible since the diameter of the wire is not extremely critical due to the use of grooved formers and adjustable cores.

offering you the widest range of pick-ups . . .

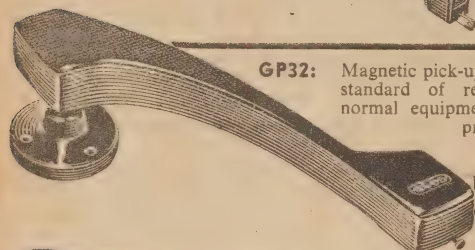
• a c o s •

CRYSTAL MAGNETIC • CERAMIC



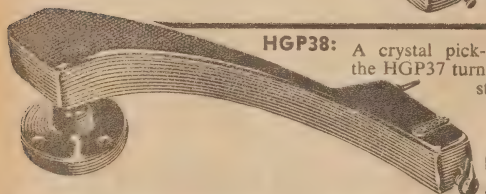
HGP40: A de-luxe crystal pick-up to satisfy the most exacting. Complete with standard and microgroove heads.

PRICE, £9/15/-



GP32: Magnetic pick-up provides a good standard of reproduction with normal equipment at reasonable price. Output voltage, $\frac{1}{2}$ volt at 1,000 c.p.s.

PRICE, £2/12/6



HGP38: A crystal pick-up. Incorporates the HGP37 turnover cartridge for standard or microgroove recordings with cantilever stylus.

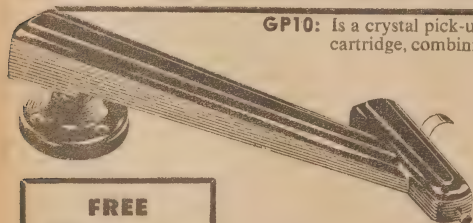
PRICE, £5/15/-

GP50: Is a HIGH-OUTPUT crystal pick-up suitable for reproducing standard and microgroove records through low-gain amplifiers as used in small record players and some radios

PRICE, £4/19/6

GP60: Incorporates the latest-type CERAMIC cartridge—unaffected by heat or humidity. For use in tropical areas.

PRICE, £6/16/-



GP10: Is a crystal pick-up utilising the GP9 cartridge, combining purity of reproduction with extreme reliability. Resonance-free response from 50/8,000 c.p.s. Output, 1.5V at 1,000 c.p.s.

PRICE, £3/12/6

FREE

Write now for illustrated technical literature on any of the products shown on this page.

plus these

• a c o s •
**replacement
cartridges**



**HGP39
CARTRIDGE**

Designed to meet the most exacting requirements of modern recordings — low element mass and very high compliance enables the heaviest modulation possible to be traced with a minimum of record wear. Both standard and L.P. heads available. **PRICE, £3/12/6**

**GP9
CART-
RIDGE**

Now famous as the

cartridge with the unbreakable crystal. Takes standard-steel or fibre needles for 78 r.p.m. records. **PRICE, £1/11/6**



**GP59
CARTRIDGE**

**A HIGH-
OUTPUT** cartridge suitable for reproducing standard and microgroove records through low-gain amplifiers.

PRICE, £2/3/-

**CARTRIDGE
GP61**

A CERAMIC cartridge that will withstand the rigours of a tropical climate and is, at the same time, very robust. **PRICE, £3/19/6**



**HGP37
CARTRIDGE**

A TURN-OVER cartridge with cantilever stylus that utilises a new method of crystal drive, a bisectional control element that achieves independent characteristics for standard and microgroove. **PRICE, £2/18/6**

Sole Agents in Australia:

AMPLION (A'SIA) PTY. LTD.

101 Pyrmont Bridge Rd., Camperdown, Sydney, N.S.W. Phone LA6124

It is possible to obtain a peep, the oscillator trimmer may have to be re-adjusted.

The actual position of the stations on the dial is set by the oscillator adjustment.

At the high frequency end of the dial, the oscillator trimmer will have the greatest effect on station setting — at the low frequency end, the adjustable core in the coil. Each time these are changed, the aerial trimmer and iron core should be readjusted to provide the best signals.

The oscillator is in all cases set to the high frequency side of the signal.

WATCH THE IMAGE

A word of warning when lining up with a signal generator may not be out of place. When shifting from the low frequency end of the band to the high, or vice versa, the receiver and the generator should be walked across in step to prevent the possibility of crossing over to our image frequency somewhere along the band.

This will completely upset alignment and apparent band coverage.

When using a generator always check that the image can be detected higher in frequency than the signal itself. If the image shows up on the low frequency side your adjustments have become confused.

With the necessary adjustments carried out the unit properly set up, plenty of shortwave stations should be audible along the band.

Many stations may be received on a makeshift aerial, but for maximum performance a good aerial is desirable. A good noise-reducing aerial, such as we have described in the past, may often be employed to advantage.

We tested our converter in conjunction with a standard portable receiver and, with a few feet of wire for an aerial it worked well.

SHORT WAVE BANDS

For the convenience of readers who are not very familiar with shortwave listening, we would say that stations will be found in fairly well-defined groups in the vicinity of 16, 19, 31, 41 and 49 metres.

These are the main world shortwave bands which lie within the tuning range of the converter. There are other bands, notably those around 11 and 13 metres, but it is not practicable in a single-band converter to include these, as the tuning coverage required would be too large.

In any case, virtually all the important broadcasts are sent out on more than one band, and you are not likely to lose much from a practical viewpoint.

The best band is something which varies with the time of the year and the time of night or day. Shortwave stations know this, and change their transmissions from one band to another in order to obtain the best coverage.

Because most of them use directional aerials and high power, you will naturally get strongest signals from the band upon which the station is sending its program for this part of the world.

This may be the B.B.C., for instance, on the 19-metre band. At the same time you might hear another B.B.C. transmission less strongly on the 31-metre band with a program aimed at another part of the world.

Most shortwave centres have pro-

(Continued on Page 119)



"NOVATAPE"

AN AUSTRALIAN RECORDER FOR AUSTRALIAN CONDITIONS WITH AUSTRALIAN PARTS.

"NOVA" pioneered the **'ON APPROVAL'** scheme, which will enable you to obtain our equipment for a FREE test without obligation to buy.

Write today for further particulars and details on our recorders and our "on approval" schedule.

SUPPORT AUSTRALIAN MADE PRODUCTS AND ALSO HAVE NO SERVICE OR SPARE PARTS WORRIES.



3 Speed
3 Motor
2 or 3 Heads, single ended, 4-watt, or push-pull 10-watt, Magic-eye or Meter Level Indicator, Place finder, Single Knob Control

"STUDIO"

A REVOLUTIONARY DESIGN OF AN EXTRA LIGHTWEIGHT HELI-REORDER AUSTRALIA HAS BEEN WAITING FOR. 34in sec. 5 3/4in Reels (1200ft), Two Tracks, 14lb weight, place-finder, 12in x 9in x 6in

★ Simple and efficient ONE-KNOB tape Control. No spilling of tape ★ 40 second Fast Forward and Rewind ★ "Differential" Brakes ★ Counter, Place-finder (Built-in) ★ Guaranteed Frequency Response ★ 1-year written guarantee.

Commercial pre-recorded tapes and tapes from broadcast stations will play perfectly, as all "Novatape" recorders are fully designed to C.C.I.R. standards.

BARGAINS: THROW-OUT OF FIRST-CLASS RECORDERS. FROM £65. PLEASE CONTACT US FOR PARTICULARS.

STOP PRESS:—

COLLARO DECKS MARK

with or without PRE-AMPLIFIER, or complete AMPLIFIER.
All coils for amplifier for above. HURRY — ONLY FEW LEFT.

OUR COLLARO AMPLIFIER HAS SWITCH FOR 3-SPEED COMPENSATION. A "MUST" FOR GOOD REPRODUCTION.

ULTRALINEAR O/P TRANSFORMERS

FOR EVERY TYPE OF VALVE. "Nova" pioneered "Ultralinear" in Australia. UP TO 12 WATT (2 impedances), £4/17/6. UP TO 20 WATT (2 impedances), £6/3/-. Other types on application.

O/P Transformers for Playmaster 1 to 11 and for the

Mullard 5-10 and 20-watt Amplifier Transformers Kit Sets

TV TRANSFORMERS

for R and H. PHILIPS and A.W.A. TV-RECEIVERS
Transformer Transformers to R. and H. and other specifications.
Rewinds and any type transformer or coil to customer's specifications.

Call, ring or write for quote on your needs

TERMS ON LOW DEPOSIT

For further details contact your dealer or

"NOVA"

311 SUSSEX ST., SYDNEY. BM6138-BM2350

Open Saturday Mornings and week nights.

MELBOURNE: WILLIAM WILKS and CO. PTY. LTD., 428 Bourke St. MU2426. R. WALLER 89 Hawthorn Rd., Caulfield. LF2921. T. BALE, 41 Roslyn St., Burwood, Vic. BW1468
CANBERRA: CANBERRA ELECTRONICS, 4 Lansborough St., Griffith. A.C.T. X1324

CUT OUT HERE

Please send, without further obligation, details of

2/58

NAME

ADDRESS

I enclose LARGE self-addressed envelope and 9d in stamps.

"3-3" QUALITY AMPLIFIER CIRCUIT

This circuit has been designed by Mullard engineers for those constructors who wish to make a simple amplifier having a reasonably high quality. It can be used with all types of crystal pick-up and it gives an output of 3 watts at a total harmonic distortion of 1%.

CIRCUIT DESCRIPTION

The amplifier, which is operated from a.c. mains, uses three Mullard valves: an EF86 as the voltage amplifier, a 6BQ5/EL84 in the output stage and a 6V4/EZ80 as the rectifier. The circuit (Fig. 1) includes three controls: volume (RV1), treble (RV2) and bass (RV14).

The comparatively high sensitivity of the amplifier (100mV for 3W output) permits the use of all types of crystal pick-up, and allows, if required, the use of equaliser networks between the pick-up and amplifier. The 3.75Ω and 15Ω output terminations are suitable for almost all kinds of loud-speaker, and, although the circuit is designed to make the most effective use of the single output valve, the best possible results will only be achieved if a suitably housed, high quality speaker is used.

The EF86 is used under 'starvation' conditions; the valve currents and voltages are very much smaller than they would be under normal working conditions because of the high resistance ($R_4=1.0M\Omega$) in the anode circuit. Direct coupling from the anode of the EF86 to the control grid of the 6BQ5/EL84 is also used. These two factors together produce a very high stage gain, and, although feedback of approximately 20dB is used around the whole circuit, an input of only 100mV is required to give an output of 3W.

The working points of the valves are stabilised by the d.c. negative feedback

provided when the screen grid feed of the EF86 is taken from the cathode circuit of the output stage.

PERFORMANCE

With the treble and bass controls in their minimum effective positions, the frequency response is essentially flat from 35c/s to 30kc/s (Fig. 2). With maximum application of the respective controls, a treble cut of 20dB is available at 10kc/s, and a bass boost of 15dB is available at 70c/s. The bass boost is obtained by reducing the main feedback at low frequencies by means of RV14 and C6 (Fig. 1).

SUMMARY OF PERFORMANCE

Output Power (at 400c/s)
3W at 1.0% total harmonic distortion.

Power Response
Flat from 100c/s to 10kc/s.

Frequency Response
Flat within ± 1 dB (relative to the response level at 1kc/s) from 35c/s to 30kc/s.

Tone Control
Maximum Treble Cut: Approx. 20dB at 10kc/s.
Maximum Bass Boost: Approx. 15dB at 70c/s.

Sensitivity
100mV for 3W output.
Hum and Noise Levels
At least 70dB below 3W.

The relationship between the total harmonic distortion and the output power is shown in Fig. 3. It will be seen that, for

a typical amplifier, for outputs above about 3.5W, the distortion increases rapidly. This indicates the point beyond which overloading of the amplifier occurs.

CONSTRUCTIONAL DETAILS

The photograph is of the prototype amplifier, and it gives a suitable layout for the main components. The dimensions of the chassis are 8in. x 6in. x 2in. The can of the electrolytic capacitors should be isolated from the chassis if the can is used as the negative side. The earth connection to the chassis is made at the input socket only. A bottom cover plate to the amplifier is not necessary.

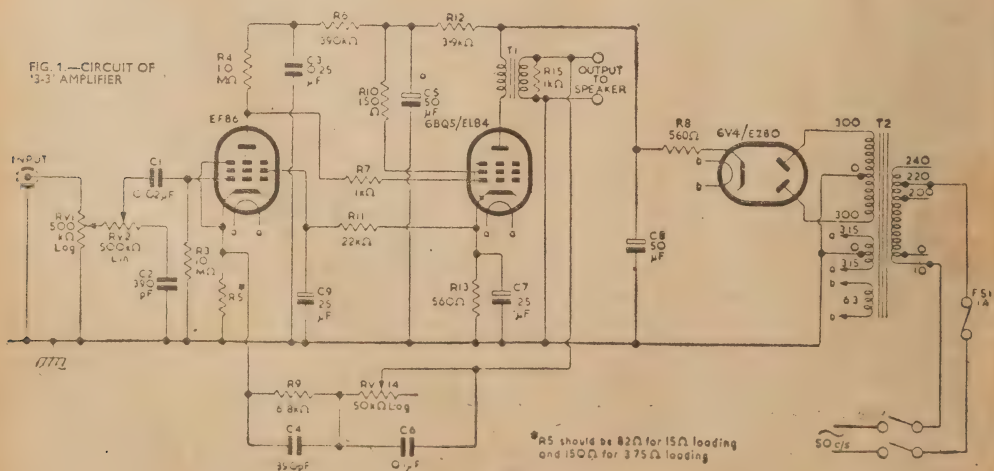
The mains transformer should have an h.t. rating of 300-0-300V, 60mA, and it is preferable, though not essential, that a separate l.t. winding (6.3V) be used for the 6V4/EZ80 rectifier. This is indicated in the circuit diagram, and also in the list of components. A transformer recommended for the low loading operation of the 5-valve 10-watt amplifier is suitable for this equipment.

D.C. CONDITIONS

Line Voltage
C8 at 48mA: 310V
C5: 295V

EL84
Anode Voltage: 290V
Cathode Voltage: 27V
Cathode Current: 48mA
Screen Grid Voltage: 295V

EF86
Anode Voltage: 30V
Anode Current: 190μA
Screen Grid Voltage: 27V
C3: 220V



LIST OF COMPONENTS

Valves: Mullard EF86, 6BQ5/EL84, 6V4/EZ80.

Resistors

RV1	500k Ω ¹	RV2	500k Ω ²
R3	10M Ω		$\pm 20\%$ $\frac{1}{2}$ W
R4	1.0M Ω		$\pm 10\%$ H.S.
R5	82 Ω $\pm 10\%$ for 15 Ω load $\frac{1}{2}$ W		or 150 Ω $\pm 10\%$ for 3.75 Ω load $\frac{1}{2}$ W
R6	390k Ω		$\pm 10\%$ $\frac{1}{2}$ W
R7	1k Ω		$\pm 20\%$ $\frac{1}{2}$ W
R8	560 Ω ³		$\pm 20\%$ 2W
R9	6.8k Ω		$\pm 10\%$ $\frac{1}{2}$ W
R10	150 Ω		$\pm 20\%$ $\frac{1}{2}$ W
R11	22k Ω		$\pm 10\%$ $\frac{1}{2}$ W
R12	3.9k Ω		$\pm 10\%$ $\frac{1}{2}$ W
R13	560 Ω ³		$\pm 5\%$ 3W
RV14	50k Ω ¹		
R15	1k Ω		$\pm 20\%$ $\frac{1}{2}$ W

¹Logarithmic; carbon. ²Linear; carbon.

³Wire-wound.

Output Transformer T1

Primary: 5000 Ω .

Secondary: 3.75 Ω or 15 Ω .

Several local transformers have been approved by our Technical Service Department. We will be glad to discuss any problems which may arise during construction of this popular unit.

Mains Transformer T2

Primary: 10-0-200-220-240V.

Secondaries: H.T. 300-0-300V, 60mA.

L.T. 3.15-0-3.15V, 1A
(For EF86, 6BQ5/EL84)
0-6.3V, 1A (for 6V4/
EZ80).

If only one 6.3V secondary winding is available, it should have a 2A rating to supply all three valves.

Capacitors

C1	0.02 μ F	Paper
C2	390pF $\pm 10\%$	Silvered Mica or Ceramic
C3	0.25 μ F	Paper
C4	390pF $\pm 10\%$	Silvered Mica or Ceramic
C5, C8	50-50 μ F	Double Electrolytic
C6	0.1 μ F	Paper
C7	25 μ F	Electrolytic
C9	25 μ F	Electrolytic

FIG. 2—FREQUENCY RESPONSE OF AMPLIFIER, SHOWING RELATIVE GAIN WITH MINIMUM TONE CONTROLS, AND ALSO WITH MAXIMUM TREBLE CUT AND MAXIMUM BASS BOOST.

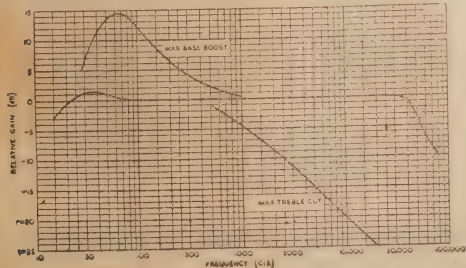


FIG. 3—TOTAL HARMONIC DISTORTION PLOTTED AGAINST OUTPUT POWER.

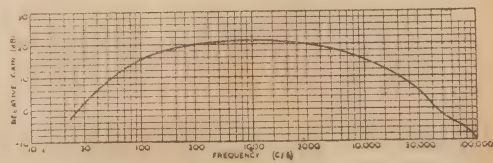
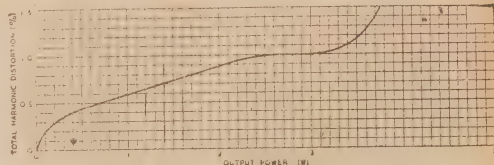
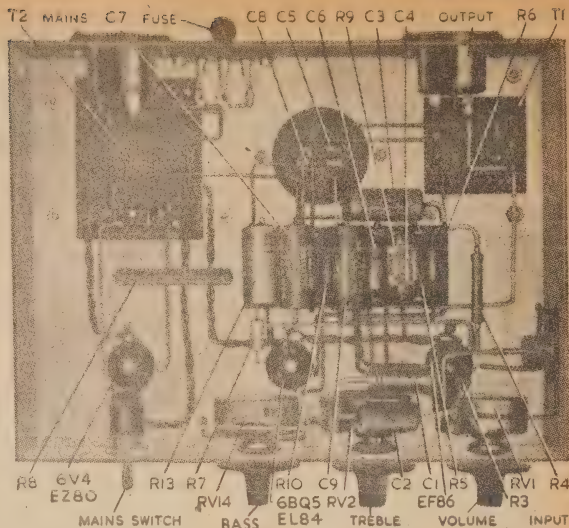


FIG. 4—LOOP GAIN CHARACTERISTICS



The illustration shows power and speaker sockets, which are peculiar to the United Kingdom. It is suggested that the A.C. power lead be passed through the chassis via a rubber grommet in the usual way. The output socket illustrated may be replaced by a standard four pin miniature speaker socket.

HARDWARE:

- 1 Audio Input Socket
- 3 Knobs
- 1 Fuseholder (1A Fuse)
- 1 Mains switch 230V, 2A
- 1 Group Board 10 way
- 1 Miniature Speaker Socket
- 3 Valve holders B9A
- (EF86 skirted, P.T.F.E. or ceramic.)

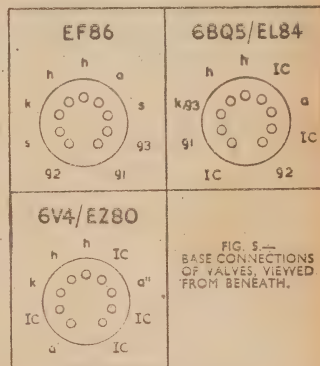


FIG. 5—BASE CONNECTIONS OF VALVES, VIEWED FROM BENEATH.

MULLARD-AUSTRALIA PTY. LTD., 35-43 CLARENCE ST., SYDNEY, BX2006. 592 BOURKE ST., MELBOURNE, MU2366.
ASSOCIATED WITH MULLARD LIMITED, LONDON, MULLARD OVERSEAS LIMITED

NEW RELEASE!

A. & R. CHASSIS AND TRANSFORMER KIT

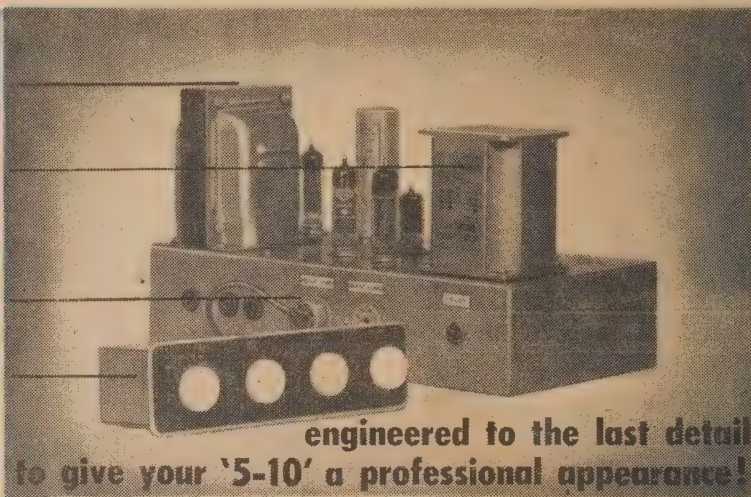
FOR THE MULLARD "5-10" AMPLIFIER!

**POWER
TRANSFORMER**

**OUTPUT
TRANSFORMER**

**MAIN
AMPLIFIER
CHASSIS**

PRE-AMP BOX



engineered to the last detail
to give your '5-10' a professional appearance!

... ANY UNIT OF THE KIT CAN BE BOUGHT SEPARATELY

UNIT "A" MAIN AMPLIFIER CHASSIS:

Comprising:—

Main Chassis.
Bottom Plate.
E.F. 86. Tube Shield.
1 Set Designation Stickers.
1 Packaged Set, Plated Nuts.
Screws, Washers, Grommets, etc.
Chassis, Bottom Plate, Tube Shield
Cadmium Plated and Passivated
Finished in Silver-Grey Hammer
Tone Enamel.

UNIT "B" PRE-AMP BOX

Comprising:—

Chassis and Cover.
E.F. 86. Bracket.
Front Escutcheon.
Full Length Register Strip.
1 Set Designation Stickers
1 Packaged Set Plated Nuts.
Screws, Washers, Grommets, etc.
Finish— As for Unit "A"

ask your A & R Distributor
for illustrated leaflet giving full
details of wiring and assembly

UNIT "C" POWER TRANSFORMER

Type P.T. 1785 — 6.3v Rectifier

Type P.T. 1786 — 5v Rectifier

Ask your nearest A. & R. Distributor for Transformer Specification Sheet giving full details

UNIT "D" OUTPUT TRANSFORMER

Type 2525/8. for 2 or 8 ohms

Type 2525/15 for 3.7 or 15 ohms

... available throughout Australia!

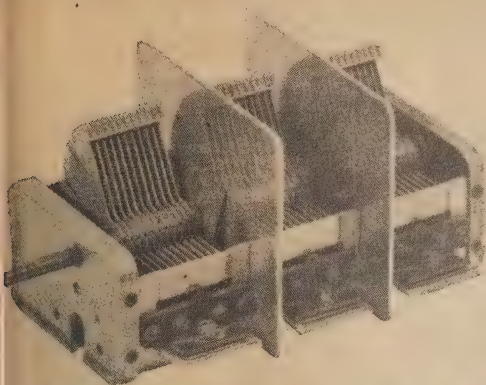
Home Constructors can now build the popular 5/10 the easy way. A. & R.'s Chassis and Transformer Kit eliminates those frustrating delays, saves you money! The general layout of the main Amplifier Chassis follows closely that shown in the Mullard Booklet 'High Quality Sound Re-production'. The Pre-Amplifier Unit has been re-designed, and both units allow the use of locally obtainable components.

MULLARD-AUSTRALIA PTY. LTD. COMMENT:— The workmanship and materials used in the Pre-Amplifier are of a high order and the lay-out open enough for the Home Constructor to have little difficulty, yet resulting in a compact, eye-pleasing unit. It complies with all our electrical specifications and is, we feel, a unit which the Home Constructor could purchase with confidence, and would enable him to complete an equipment of both "Professional" performance and appearance!

DISTRIBUTORS: VICTORIA: Homecrafts P/L, J. H. Magrath & Co. P/L, Radio Parts P/L, Warburton Frank, A. E. Harrold, 123 Charlotte St. Brisbane Messrs Chandlers P/L, Cnr Albert and Charlotte Sts. Brisbane, Trackson Bros., 157 Elizabeth Street, Brisbane. W. AUST.: A. J. Wyle P/L, 1064 Hay St. Perth. TAS.: Homecrafts P/L, 220 Elizabeth St., Hobart. N.S.W.: United Radio Distributors P/L, 175 Phillip St., Sydney Homecrafts P/L, 100 Clarence St. Sydney. AGENTS: R. H. Cunningham & Co. P/L, 16 Angus St. Meadowbank.

A. & R. ELECTRONIC EQUIPMENT CO. PTY. LTD.

378 St. Kilda Road, Melbourne, S.C.1 MX1150, MX1159



An old-style "bath-tub" ganged capacitor, one of the first to appear in quantity in Australian-made radio receivers. It was widely used in early TRF consoles. Note the trimmer capacitors on the near side, one to each gang section. The trimmers were notable, if only because they became "hard-to-get-at" with the gang plates open — the very position in which access was required!

The How and Why of Receiver Alignment

In any but the simplest receivers, performance depends a good deal on the accuracy with which the various tuned circuits are aligned. This instalment discusses the subject of receiver alignment with a double purpose in view—to explain what it is all about and to provide enough information for home constructors to align their own receivers, upon completion.

THE inclusion of a chapter on alignment may seem rather out of keeping with earlier and more elementary material, or the absence from the course of actual receiver constructional data.

In point of fact, however, it is reasonable to assume that many readers will have tried their hand at building one or more of the receivers described elsewhere in the magazine and may by now be facing up to this very subject.

PURPOSE OF ARTICLE

Such being the case, it seems appropriate to do three things:

(a) Explain what is behind this matter of alignment and why it is necessary at all;

(b) Discuss some of the side-issues as, for example, dial settings, alignment tools and so on;

(c) Give an alignment procedure for both TRF and superhet receivers.

Even if the reader does not happen to have a receiver on the table, awaiting attention, the information should be useful and will be available against the day when it may be required.

Thirty years ago, the word alignment was virtually unknown.

For the most part, each tuning circuit in receivers of the day was brought out to a separate tuning dial and tuning involved turning each dial to the appropriate setting for the particular station.

In fact, a standard accessory at the time was a card listing local stations, with two or three spaces alongside each,

in which the set owner could insert the dial readings for optimum reception.

As time went by, designers sought to simplify matters by making all the tuning coils and capacitors as nearly identical as possible, so that the dial settings would correspond fairly closely. Thus, the owner could remember if he wished that a certain station came in with all the dials set to about 70, another station with the dials about 55 and so on.

From here, it was an obvious step to take even greater care with the tuning circuits and arrange them so that they could all be adjusted simultaneously by rotating a single tuning knob. At first, the individual tuning capacitors were linked behind the panel with gears or belts. Later, they were combined into the one assembly as a two, or three or even four-gang capacitor. Thus "single-dial tuning" became the vogue.

STRAY CAPACITANCE

Single-dial tuning has been with us ever since and is obviously a very convenient feature. However, several tuning circuits will not remain exactly in step—or TRACK—accurately just because they are superficially alike. Special provision has to be made to ensure that the ganged tuning circuits all resonate to the correct frequency at each and every setting of the tuning dial.

By very carefully maintaining the number of turns on the coils during manufacture and by matching the tuning gang sections, fairly good tracking can

be obtained, as a matter of course, near the low frequency end of the range: that is, with the tuning capacitor plates well into mesh.

However, at the other end of the band, with the capacitor plates well out of mesh, the exact tuning of the circuits is affected, as much as anything, by STRAY capacitance—that to do with the valves, the position of the connecting leads and so on.

TRIMMER ADJUSTMENT

Variation in this stray capacitance between one tuning circuit and another leads to tracking error at the higher frequencies, and therefore loss of efficiency. To overcome this problem, it has become accepted practice to connect small mica compression type capacitors in parallel with each tuned circuit. Known as TRIMMER capacitors, they are commonly adjustable between about 10 and 30pF. Sometimes they are separate components; sometimes included as part of the ganged capacitor.

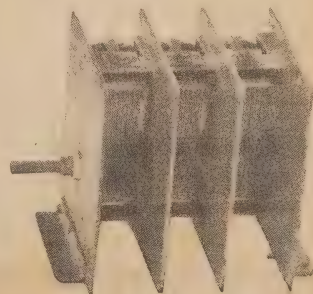
Normal intention is for the trimmers to be set at about half capacitance, the tuning coils and the gang itself then being designed to cover the requisite band of frequencies—from about 1,700 to 535Kc, for the ordinary medium-wave broadcast band.

If the stray capacitance across one or more of the tuned circuits happens to be a little high, then the relevant trimmer or trimmers are unscrewed a little. Conversely, if the strays happen to be low, the trimmer can be screwed in a fraction to increase the amount of capacitance to the anticipated figure.

Provided that the coils and gang sec-

tions are accurately manufactured, the tuning circuits thus aligned at the high frequency end of the band, remain reasonably in step over the whole tuning range.

In more recent years, a new technique has been evolved which leaves even less to chance at the low frequency end of the tuning range. This involves the provision of an adjustable iron dust slug inside each tuning coil. Moving the core in or out of the winding changes the inductance by quite a large percentage.



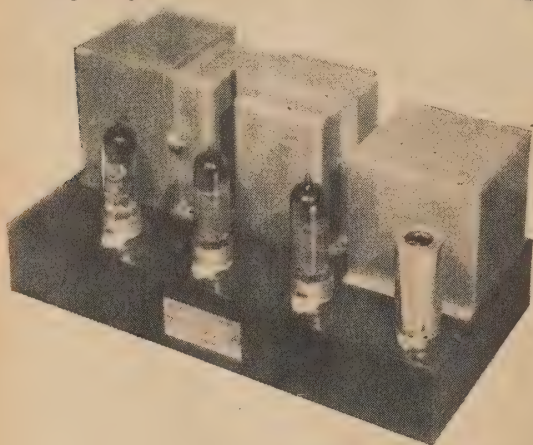
Another early type of ganged capacitor, a model of which largely displaced the one shown above. Note the trimmers, this time located on top of the assembly.

NEW RD JUNIOR

High Fidelity System

AMPLIFIER

- "Ultra Linear" output stage (Mullard EL84.s in push-pull).
- Output Transformer with grain orientated laminations.
- Exceptional power/frequency response curve.
- High margin stability.
- Unique "Impedance Plug" speaker matching.
- Ample Spare Power.



CONTROL UNIT

- Four Record Characteristics.
- Two Radio Inputs.
- Provision for microphone.
- Simplified pick-up matching.
- Tape Record and Replay sockets.
- Switched Bass and variable Treble controls.
- Ultra Compact.
- Independent continuously variable low pass filter.

TECHNICAL SPECIFICATIONS

Frequency Response: + or - 1 db 30-2,000 cps. 10 watts .12% at 1 kcs 12 watts .2% at 1 kcs.

Hum and Noise: -85 db below 8 watts.

Output Impedance: 12-16 ohms. 6-8 ohms. 2-3 ohms

Spare Power: 285V. at 40 m/A. 6.3V. 2.5A.

Overall Dimensions: 11" long, 6" deep, 5½" high.

Weight: 15 lbs.

Operating Voltage: 200-230-250V. 50 cps.

Demonstrations and Supplies Available from

- NEW SOUTH WALES: United Radio Distributors Pty. Ltd. Audio Engineers Pty. Ltd.
- VICTORIA: Homecrafts Pty. Ltd., J. H. Magrath & Co. Pty. Ltd., Radio Parts Pty. Ltd. Warburton, Franki (Melbourne) Ltd.
- SOUTH AUSTRALIA: Gerard & Goodman Ltd. Newton McLaren Ltd. Radio Electric Wholesalers Ltd.
- QUEENSLAND: Chandlers Pty. Ltd.
- WESTERN AUSTRALIA: Atkins (W.A.) Ltd. Carlyle & Co. Ltd. Leroya Industries Pty. Ltd.

Sole Australian Agent:

BRITISH MERCHANDISING PTY. LTD.

BOX 3456 G.P.O. SYDNEY

Thus, in modern receivers very accurate alignment can be achieved by adjusting the cores for exact inductance balance at the LOW FREQUENCY end of the band and the trimmers for capacitance balance at the HIGH FREQUENCY end of the band.

Note that the cores and trimmers perform different functions and they should always be adjusted to fulfil those basic functions. The fact that tuning circuits include variable iron cores therefore does not obviate the need for trimmers.

There is another facet to this matter of alignment which must be mentioned.

SHAPE OF PLATES

Originally, receivers used tuning dials simply numbered 0-100, leaving the set owner to memorise the tuning position for each station. Provided the receiver tuned over the necessary frequency band, the exact position of the stations within that band did not matter a great deal. Thus trimmers and possibly cores could be set for adequate tracking, without special reference to the dial readings.

More recently and, in fact, for many years, station call-signs have been marked directly on the dial scale. This means that the trimmer and core settings and the position of the pointer relative to the tuning gang shaft must be determined for accurate indication of the incoming station as well as for accurate alignment.

It involves also, one other important point. There is some variation from one type of ganged capacitor to the other in the maximum and minimum capacitance figures and the shape of the moving plates. This affects the distribution of stations across the dial scale.

In an existing receiver, it can usually be assumed that the dial has been calibrated to match the particular ganged capacitor and correct alignment should therefore bring the stations in on their calibrated positions.

In a home-constructed set, however, there is a chance that a dial might be used having a glass calibrated for some gang capacitor other than the one used. In this case, no amount of manipulation of the cores and trimmers may succeed in getting the stations to come in at the right positions on the dial.

ALIGNMENT ESSENTIAL

In assembling components, constructors should therefore see to it that the dial glass is for the type of gang capacitor selected.

In the case of a superhet receiver, there is more to alignment than merely getting two or three tuned circuits to track, one with the other. This much will be evident from our explanation in the October issue of the superheterodyne principle.

Alignment involves getting all the IF transformer windings resonated to the appropriate frequency, usually 455Kc. It then involves getting the oscillator circuit to track with the aerial and possibly RF circuit the requirement, in this case, being that the oscillator tune at all times 455Kc higher than the signal frequency.

This sounds a rather formidable task but the desired result can be achieved by following a fairly simple routine, which will be described later.

By now, the reader should have a fairly clear idea as to what alignment is all about. It should be equally clear that a receiver which has not been

aligned cannot operate efficiently, because its various tuning circuits will be a long way out of step.

So much for section (a)—why alignment is necessary. Now for a few of the side-issues.

In a factory, receivers are aligned with the aid of a signal generator and an output meter and there is no doubt that the most accurate job can be done in the shortest time with their aid.

Since this is essentially an article for beginners, however, we do not plan to say overmuch about alignment procedures using such instruments. Anyone owning them or having access to them is

Ganged capacitor plates are specially shaped to distribute stations more evenly over the dial scale but plate shapes vary from one type to another. The dial glass must therefore suit the gang and the pointer also should ideally be locked in a specific position relative to the gang rotation.



(Below) Typical trimmers, compared in size to a penny, which are used when trimmers are not already fitted to the gang. Note that the side making contact with the adjusting screw should be connected to the "earthy" side of the circuit. This avoids upsetting the peak when the screw is touched with a metal screw-driver.



likely to have access also to first-hand advice on their use.

The average home constructor is likely to have to rely on broadcast stations for a source of signal and to rely on his ears to indicate whether an adjustment has brought about an increase or a decrease in sound volume. Nevertheless, providing care is taken, quite good alignment is possible by these means.

STATION CALLS

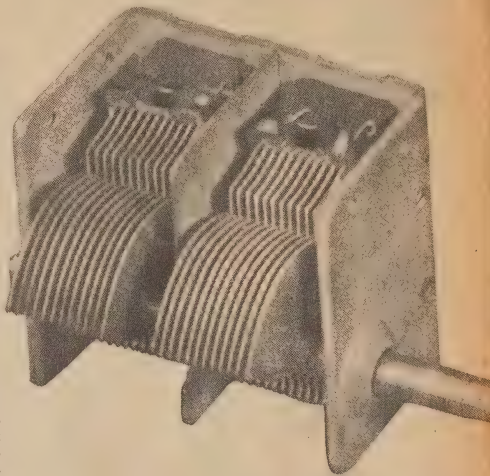
If the alignment is to proceed smoothly, a few preliminary points must be checked, some of which have already been mentioned in passing. Firstly, there is the action of the dial mechanism and the setting of the pointer relative to the dial scale and tuning gang plates.

If the receiver has a simple 0-100 dial scale with no station call signs marked,

it is only necessary to drive the tuning gang smoothly between the full-in and full-out positions and that the pointer travels over the scale with any overlap about equal at the two ends.

The pointer travel can be corrected in some dials by loosening a screw or slipping the tuning gang cord through a loop. In others, it involves loosening the grub-screws locking the dial to the gang shaft and retightening the screws with the two in different relative positions.

With dials having the station calls marked on them, the position is rather more confused. Because the capacitor plates are specially shaped, precise track-



ing can only be expected if the pointer and its travel is locked to the gang shaft in one specific position—that for which the dial was originally calibrated.

With the two in the wrong relative positions, stations may be brought to correct calibration at the two ends of the bands by manipulation of the cores and trimmers, but those near the centre may be displaced slightly one way or the other.

Some dials—but not many—have a "dial set" line marked just beyond one end of the scale. The intention is that the dial shall be locked to the gang shaft with the pointer set to this reference line and the gang plates either full in or full out, depending on which end of the scale is involved.

LOW FREQUENCY POINT

Where there is no "dial set" line, the pointer can only be locked in a likely position and the alignment procedure followed out. If the stations can duly be made to fall in the calibrated positions, the pointer can be left set; if not, the pointer may have to be reset slightly one way or the other in relation to the gang shaft and the alignment procedure repeated, noting whether the new position has improved matters or otherwise.

Alignment instructions often suggest that the pointer should be set initially for "equal overlap" at the two ends of the scale. In our own experience, however, we have often found that the following procedure gives an optimum pointer setting at first trial:

Measure the distance between the 550 Kc calibration point and the 600 Kc point. Divide the distance by two and set the pointer on the low frequency side

NOW AVAILABLE...

PHILIPS

New Automatic multi-function record changer



Type NG 1010

PRICE

£25.18.0

240 Volts
50 CYCLES AC

The new NG1010 multi-function record changer combines a simple push button record changer with an automatic record player of completely new design. It incorporates the latest technical refinements for simplicity of operation and trouble-free service. The unit is attractively finished in Gold Hammer-oid with burgundy tone arm. The turntable is flock sprayed and effectively cushions the records and so avoids damage. Completely automatic, just load up to 10 records (all sizes or a similar speed intermixed), press the start button and forget. The unit cuts off after the last record and, of course, mutes the pick-up during the change operation and the record can be placed directly on the turntable. Select the record size, push the start button and the arm is lowered safely and gently on the record with a precision not possible by hand. Push the stop button and the pick-up arm returns to its rest at the finish of the record and switches off.

- Automatic Record Changer, Automatic Player and Manual Player in one unit.
- Push Button operation — Simple and foolproof.
- Plays 7", 10", 12" records of same speed intermixed.
- Featherweight pick-up arm with detachable dual stylus, pick-up head — muting switch.
- All record speeds: 78, 45, 33 1-3, 16 2-3 r.p.m.
- No interfering rumble or wow.
- No record damage.

P6142.57

PHILIPS ELECTRICAL INDUSTRIES PTY. LIMITED

Sydney • Melbourne • Brisbane • Adelaide • Perth • Hobart

of the 550 Kc calibration point by this amount. Lock the dial drum with the capacitor plates fully in. The lower limit of the band will thus be about 535 Kc. Before going further, make sure that the dial will rotate the capacitor between the limits of its travel without obstruction, or straining the cord in a cord-drive type. If there is any such trouble, it should be corrected before spending time over the alignment.

MAY BE "HOT"

In cord-drive dials, the tension of the cord is also important. If it is too loose, the cord will slip. If too tight, it may bind and ultimately break. In general, it is best to have the cord twisted twice around the control knob shaft, with the tension no higher than necessary to ensure positive drive.

Depending on the receiver, a special alignment tool may or may not be required.

Most trimmers are adjustable with an ordinary small metal screwdriver. As a rule, they are connected into circuit so that the screwhead makes contact with the trimmer plate, which returns to earth or to the "earthy" side of the circuit. If touching the trimmer with a metal screwdriver alters the signal level, the chances are that it has been installed the wrong way round.

The trimmers in many early type IF transformers are likewise adjustable with a small metal screwdriver. Fingers should be kept off the shaft, however, and the blade kept clear of the metal can, because the trimmers on the plate side often connect internally to the B-plus circuit.

Iron cores are often adjustable also with a plain metal screwdriver, notably cores which are attached to threaded brass rods protruding from top and/or bottom of the shield cans. In some cases, where the threaded rods are not earthed, touching them with a metal

engage a similar hole in moulded cores of a somewhat different type.

So much for what we referred to earlier as the "side-issues." Now for the actual alignment procedure, which must needs be subdivided into "TRF" and "Superhet."

TRF receivers are fairly rare, these days, but there may be enough of them in the hands of home constructors to warrant at least brief mention.

In old-style TRF sets, of the type current about 1930, the only adjustment normally provided is to the three trimmer capacitors, usually mounted as part of the main tuning gang. There are no variable cores and no station-calibrated dials.

The procedure, in such cases, is simply to examine and check the action of the dial and travel of the gang, for reasons already explained.

The receiver should then be tuned to a station near the high frequency end of the band, at somewhere about 1300Kc. Keeping the volume low, each of the three trimmers should be adjusted in turn to achieve any possible increase in receiver gain, and therefore volume.

RE-PEAK TRIMMERS

If one of the trimmers should have to be screwed hard down, without passing through a peak, the remaining two should be unscrewed by a turn or so, the dial reset, as necessary and the "difficult" one re-peaked. Alternatively, should one or more trimmers not peak, even when screwed full out, the remaining trimmers should be screwed in and the dial reset as necessary until all trimmers peak satisfactorily.

If the dial should be calibrated in terms of frequency or station call sign in such a receiver, the first step is to tune a station near the low frequency end of the band (about 600Kc) and set the pointer to indicate the station correctly.

the cores for highest sensitivity and output.

Now check the accuracy or otherwise of the station indication. If the station is coming in at too high a frequency, on the dial scale, unscrew all the cores a turn or so, move the dial towards its calibrated position and re-peak. Repeat the procedure until the dial pointer is indicating the particular station accurately. Make sure that all cores are peaked.

If, of course, the station appears at too low a frequency on the dial scale, all cores have to be re-peaked further in.

Having obtained correct calibration at the low frequency end of the scale, tune to a high frequency station, again about 1300Kc. Peak the trimmers and check calibration at this end of the scale.

TRIMMER PEAKING

As before, if adjustment is necessary, screwing all trimmers in and re-peaking will move the incoming stations towards the high frequency end of the scale. Unscrewing the trimmers and re-peaking will have the opposite effect.

Having peaked the trimmers, tune the low frequency station in, again and re-check the cores. Then go back and check the trimmers on the high frequency station.

In describing this and the preceding operations, we have assumed what might be called a "static" approach, each step towards correct peaking and calibration being quite distinct.

An experienced serviceman is likely to adopt a much more sweeping approach to alignment with a TRF receiver. He may select a strong signal at the low frequency end of the band, then turn up the gain and/or screw the cores rather wildly—anything to bear the signal even weakly with the dial pointing to the calibrated position. The cores are then peaked for maximum output without touching the dial further.

FINAL STEP

As a final step, he may then tune the set to an adjacent weaker signal and give the cores a final touch-up.

Likewise for the trimmers at the high frequency end of the band.

Another time-saving serviceman's trick is that of rocking the dial while aligning the cores or trimmers.

The dial is simply rocked back and forth over the reference station and note taken of its general strength and peak position. The cores or trimmers are then progressively screwed in or out as required, the dial being rocked meanwhile, until maximum response and correct calibration is obtained.

But whatever the method remember that, in all this, there is a "golden rule" of alignment about cores and trimmers:

Adjust the cores only on low frequency signals. Adjust the trimmers only on high-frequency signals.

This is part one of the article. Next month we will have something to say about aligning superheterodynes, also the possible effect of instability.

(To be continued)

NOW WE'VE HEARD EVERYTHING!

According to a recent report in "Electronics" (Business Edition), space suits are being used to allow engineers to work inside a vacuum chamber pumped down to a sufficient order to allow valves to operate normally without envelopes. This is happening in the Lab. at Litton Industries. Electrodes of the valve can be moved while the tube is in operation to find optimum positions for the desired results. Chief use to date is for work on the Chromatron colour TV tube.

object will affect the behaviour of the coil, making it difficult to pick the proper peak position.

To overcome this difficulty, a type of alignment tool has been available for many years having a very small metal screwdriver tip embedded in a moulded handle.

Alternatively, if the cores are not too stiff in their action, a suitable non-metallic screwdriver can be made by sharpening a piece of ebonite rod to a wedge point.

ALIGNING TRF SETS.

In recent months alignment "screwdrivers" have been made available of nylon or similar material and these are also very handy for adjusting cores which have a screwdriver slot moulded directly into their ends.

A still further type of alignment tool has a hexagonal end meant to

The receiver should then be tuned to a station around 1300Kc and the trimmers peaked as just described. Now observe the accuracy or otherwise of the station indication.

If the station is being received on the high frequency side of its calibrated position—that is with the gang plates too far open—it may be moved towards its calibrated position by re-peaking all trimmers in a further-out position.

Conversely, screwing all trimmers further in and re-peaking will move a station towards the high frequency end of the scale.

If a TRF receiver has variable cores as well as trimmers, the procedure is first to set the dial to the "pointer set" line or for equal overlap or to indicate an approximate 535Kc as the lowest frequency (see earlier paragraphs).

Having set the dial pointer, tune a station in the vicinity of 600Kc and peak



His observations are generally in line with what we have said, and need no further comment. I only hope that they help further to dispel the idea that still seems to be abroad, that television should be viewed in darkness.

Coincidentally, while I was in the very act of typing these paragraphs, an acquaintance walked into the office with the news that he had just installed a television set. His words:

"It's a bit tough on the eyes, though."

WATCHING IN DARKNESS

In answer to my question, he said that he had been watching the picture in darkness and seemed very surprised at the thought of viewing under any other conditions. He had simply transferred the customary darkness of the theatre to his own living room, failing to understand the differences between the two methods of presentation.

I'm afraid the same thing happens repeatedly.

So much for that. Overseas, in the U.S., an argument verging on a public scare has been raging about X-ray radiation from cathode-ray picture tubes. This is a subject which has been raised in vague fashion locally for some time.

To give you the "meat" of the U.S. controversy, it is really only necessary to reprint in sequence some of the news

Let's Buy An Argument

About this time every year, I have a clean-up — a sorting out of all the oddments and snippets and items which did not quite make the "Argument" columns because, at the time, there was something more urgent or pertinent to be included. If this month's effort seems rather disjointed, therefore, you have the explanation.

Our remarks of a few months back about television viewing conditions and the subsequent report of Mr Lederer's lecture on the same subject have continued to promote thought and comment, though not of an order to warrant publication.

Most people admit the feasibility of our own suggestion that line structure is not a major problem in typical television viewing; that it is not a major visual hazard and that people should not necessarily be invited to sit at a distance from the screen where line structure cannot be resolved.

GREATER STRAIN

We contended that the strain of viewing a picture from too great a distance, or subtending too small an angle at the eye, was far greater than any resulting from the scanning routine.

Certainly no one has denied it, though this doesn't indicate that no one is prepared to.

On the subject of ambient light, I had a quite lengthy discussion with a lighting engineer, who disagreed with Mr Lederer's figure of 10-foot Lamberts for

the surround of a typical television image. He pointed out that this order of light would be given by several concealed 40-watt fluorescent tubes in a room or at least one such tube shining on to the wall immediately behind the receiver.

He agreed with the idea of adequate ambient light, but not that much!

I personally expressed the opinion at the time that the figure quoted was too high, and much more than I used in my own home.

On the same general subject, we reprint opposite a letter from a reader who makes no claim to special optical knowledge, but who has apparently taken his television viewing very seriously.

items and comments, exactly as they appeared in our contemporary "Radio Electronics."

The August issue carried the following news par, with Editorial comment:

"A radiation scare, due to a statement by New York State Commerce Department research consultant Dr James B. Kelley, was still having repercussions at the time this issue went to press.

"Dr Kelley told the Radiological Safety Conference held recently at Buffalo, N.Y., that boosters used on aging picture tubes might convert them into sources of mild X-rays. A standard black-and-white receiver, Dr Kelley said, uses about 15,000 volts, but a booster uses 30,000 to 40,000. Medical X-rays start at 50,000 volts.

"It was pointed out to Dr Kelley that the common picture-tube brightener (booster) increases the heater voltage only and that by just a few volts.

"Newspapers reported that he had backed down on his earlier statement, explaining that he was not entirely familiar with the operating principles of the standard TV tube booster. But, two days later, Dr Kelley insisted that he had not retracted his original statement, and

by **Neville Williams**

emphasised that he had personally seen V sets which had their anode voltages raised from the usual 15,000 to as high as 30,000 or 35,000 volts.

"Since the average picture tube would not handle much more than 20,000 volts without breaking down, and since detection voltages would not be sufficient to produce a picture over more than a small portion of the screen if the anode voltage were greatly increased, it is not clear how these sets could have operated.

"In any event, none of Radio-Electronics' technical staff has ever seen or heard of a boosted receiver such as Dr Kelley describes. Meanwhile many set owners have been alarmed needlessly. The one good angle in the whole unfortunate mess, some TV owners will have few picture tubes installed."

EFFECT ON EHT?

Following up the matter, the publishers of "Radio-Electronics" sought expert opinion as to whether TV tube boosters did in fact increase EHT voltage. A typical reply came from F. L. Baker, of the Texas Electronics Association. I quote:

"Dear Editor:

It is true that a booster increases the filament voltage. However, it lowers the high voltage. It does it this way: As a picture tube gets older it pulls less current and the high voltage, which is unregulated in the average set, goes up. If you put a booster on a set or replace the tube, the set draws more current from the high-voltage supply, which in turn lowers the high voltage."

In the same issue, a letter from Dr. Kelly, who had started it all, showed that most of the discussion about "boosters" had been based on an unfortunate misunderstanding, but he went on to clarify his statements on the matter.

It would appear from his letter and from other references I have seen, that the danger line is approached with colour TV tubes or, perhaps, very large black and white tubes. However, here's what he has to say:

"Dear Editor:

I am sorry that I was unable to answer your letter of July 1 sooner, but I have been out of the country for some time and as a consequence have fallen behind on my mail.

WRONG IMPRESSION

"With regard to the question you raise concerning a report of research done on television boosters, I should like to correct what is apparently a misunderstanding on your part.

"At a Radiological Safety Conference held from June 12 to June 14 at Canisius College in Buffalo, N.Y., I delivered a paper entitled 'Basic Physical Principles of Ionizing Radiation.'

"I did not discuss television in that paper. However, in an interview with a reporter for the 'New York Times' which I gave after I had delivered my paper I mentioned the fact that I had seen television receivers that had had their voltages boosted to levels which were approximately those at which soft X-rays might be given off.

"Since the term booster has a technical significance in the television repair business, there was some confusion over my use of the word boost in a generic rather than technical sense.

"My opinions are based on sets which

LIGHTING FOR TV VIEWING ROOM

At the outset let me say that I always read your "argument" articles with interest and have often been prompted to join in on various matters. However, up till now I have not done so but your request for "observations" on viewing conditions for TV causes me to offer mine.

Several years ago I decided that I would have a TV receiver as soon as they became available in this country. Therefore I set out to learn as much as possible about desirable qualities in receivers from as many sources as possible, your magazine included. The receiver which most nearly fitted my idea of an ideal was a 17-inch type in a maple console cabinet, which I obtained three days before the start of regular transmission (September 1956).

SPEAKING FROM EXPERIENCE

After watching this, with other members of the family, and also viewing other receivers under various conditions I feel qualified to offer some observations. At first, while the receiver was new, and we had many visitors it was placed in the lounge room (see fig. 1) in the position marked and the chairs arranged, brought from other rooms, as in a theatre. A standard lamp (S) was placed beside it, this lamp being fitted with a semi-translucent fabric shade and a 40 watt lamp. Also a small cork mat was placed inside the bowl in front of the lamp to prevent direct light reaching the viewers' eyes.

Two side lamps (L) at the back of the room were also lighted most of their light going to the nearby floor and to the ceiling (white).

Looking back I cannot remember being troubled by eye strain after viewing under these conditions but I cannot recommend them for at best they were emergency conditions for coping with a large number of visitors.

This year we fitted the receiver cabinet with wheels and moved it to another room (see figure 2). When not in use it occupies the position P1 beside the speaker enclosure S but when required it is pulled out to approximately P2 or other convenient position in the room.

For viewing at night two 40 watt fluorescent lamps across the room at F are lighted (see figure 3). The direct light from these extends only to a maximum of 8 feet from the wall, as shown, meaning that this section of the room is brightly lit while the rest is lit only by reflected light.

DAY, NIGHT VIEWING ALIKE

When viewing during the day the venetian blinds are turned so that the outside light falls mainly on the ceiling, providing the room with a general, even light.

With the above conditions no change in screen brightness is required when changing from day to night viewing.

No one in the family has complained of eye strain and about half the time spent "watching television" is actually occupied with reading the newspaper, knitting, etc., so that the eyes are not concentrating on a small patch of light all the time.

Most of our friends are surprised at the brightness of the room and more surprised at the absence of eye fatigue even after hours of viewing. I venture to suggest that this has changed many opinions about the merits of television.

In conclusion I agree about the desirability of a filter-glass and a light mask around the screen. Especially I dislike the receivers with the black line around the screen due to the thick glass edge of the picture tube. This provides too sharp a cut-off for the picture and, to me, makes it appear smaller.

Thanking you for your stimulating articles in the past,

Yours faithfully,
P.B.

P.S. The viewing room is painted light blue and yellow.

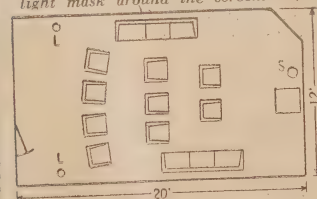


Figure 1: Layout of original viewing room.

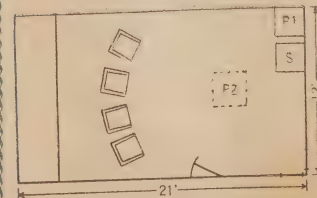


Figure 2: Present layout of viewing room.

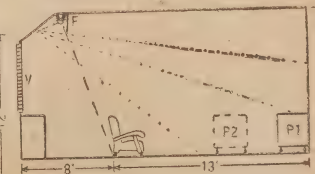


Figure 3: Side elevation of room showing fluorescent tubes shaded to prevent direct light falling on receiver screen.



MINIATURISED RADIO & TV Components

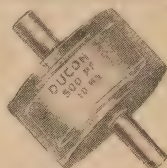
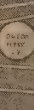
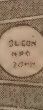
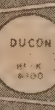


TYPE CAE—Screw mounting stand-off variety in capacity ranges of 100 pf. min. to 3000 pf. max.

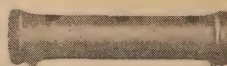


TYPE CAC 100—Feed-thru flange mounting type can be soldered direct to the chassis or shield plate in tuner units. From 50 pf. min. to 1500 pf. max.

The disc ceramic, with its short rf current path, when soldered direct to the tube terminals, reduces the inductance to very small values.



Type TV high voltage disc capacitors encased in "DURITE" for T.V., and other high voltage applications.



Ceramic, used as a dielectric, prevents instability occasioned by laminations, pores and air pockets.

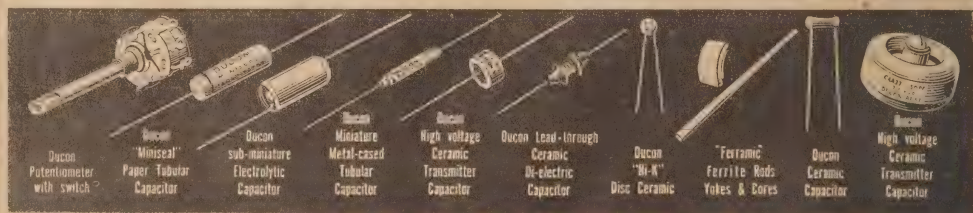
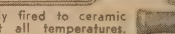
Silver electrode for maximum conductivity.



Heavily tinned leads soldered direct to silver electrode.



Electrodes permanently fired to ceramic complete stability at all temperatures.



Ducon Potentiometer with switch

Ducon "Minisat" Paper Tubular Capacitor

Ducon sub-miniature Electrolytic Capacitor

Ducon Miniature Metal-cased Tubular Capacitor

Ducon High voltage Ceramic Transmitter Capacitor

Ducon Lead-through Ceramic Hi-electric Capacitor

Ducon "Hi-K" Disc Ceramic

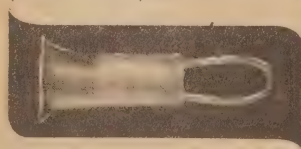
Ferramic Ferrite Rods Yokes & Cores

Ducon Ceramic Capacitor

Ducon High voltage Ceramic Transmitter Capacitor



TYPE CAC—Feed-thru flange mounting type can be soldered direct to the chassis or shield plate in tuner units. From 50 pf. min. to 1500 pf. max.



TYPE CAE 100—Stand-off flange mounting style mounted by soldering to the chassis. From 50 pf. min. to 1500 pf. max.



New modern Leightonfield Works provide further expansion for Ducon manufacture and expedience of delivery.



DUCON CONDENSER LIMITED

Christina Rd. and Birmingham Ave., Villawood, N.S.W. U80133.

SUBSIDIARY COMPANIES:
Simplex Products Pty. Limited.
Mica Products Pty. Limited.
Ducon General Ceramics Pty. Limited.
Ducon (N.Z.) Limited, 21 Grey St., Wellington, 42-411.

VICTORIAN OFFICE:
Ducon Condenser Limited, 83 William St., Melbourne, M84471.

INTERSTATE AGENTS:
Wm. T. Matthew Ltd., 95 Grenfell St., Adelaide, W3361.
P. H. Phillips Pty. Ltd., 458 Brunswick St., Brisbane, LW2011.

H. J. McQuillan Pty. Ltd. 7 Queen's Place, Perth, W.A. BA8911.

ASSOCIATE COMPANY: P. R. Mallory & Co. Pty. Ltd.

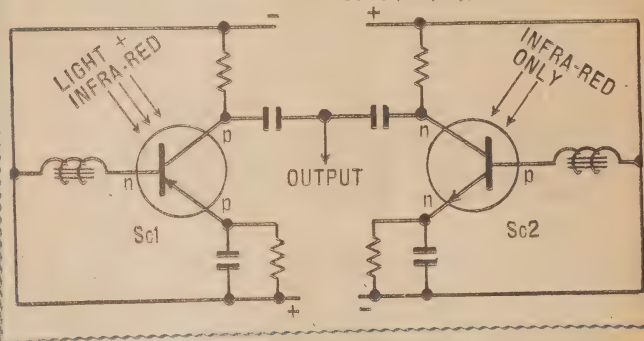
ONE FOR TRANSISTOR MAKERS

To Mr. Neville Williams.

Let's buy an argument (with transistor manufacturers.)

1. Transistors are inherently heat sensitive.
2. The infra-red sensitivity of photo-transistors, is, in some cases, (namely mine), undesirable.
3. Correction by use of negative temperature coefficient resistors is not sensitive enough when infra-red radiation is incident on the photo-transistor for short periods only.
4. Is the idea behind the accompanying circuit a step in the right direction?
Sc1: p-n-p photo-transistor.
Sc2: n-p-n transistor (matched for output due to heat, with Sc1.)
The two are mounted side by side.
(Left-hand side of above circuit straight from Philips' "Minuwatt" Transistors booklet.)
5. If this method is feasible, and of use to a large enough number of people, then in the future (perhaps), we may be supplied with matched pairs of the above-mentioned, just as we may now purchase matched pairs of transistors suitable for class B operation.
6. But I have forgotten one important item. Where are the n-p-n transistors?

Yours faithfully, D.L.E.



reading was indicated. However, this reading (at the usual voltages in black-and-white TV sets) was so low that a person would have to spend six to eight months near the neck of the picture tube (or inches from it) to get enough radiation to pass the minimum safe requirements (100 milliroentgens per week) of the Radiological Safety Conference.

"There is, however, a more serious danger point. That is at or near the 1B3, 1X2 and 1V2 tubes used as rectifiers. Here, X-ray dosages were such that a long exposure of perhaps an hour, at 6in from these tubes, could cause an overdose of these soft rays. Fortunately, these tubes are usually enclosed in a metal can or placed under the chassis in where the X-rays are heavily absorbed.

NO READINGS

"No reading of any value was available from sets in their cabinet or from sets where all the hardware was in place. My measurements were made within 6in since, frankly, I cannot see anyone getting closer than this to a 'hot' high-voltage rectifier.

"My conclusions from this were very definite:

1. A properly manufactured TV set gives off no appreciable radiation to the user or his family.
2. A properly manufactured TV set has sufficient protection so the service technician need not be worried.
3. A technician who has developed suitable methods of working so that

he does not allow himself to get close enough to high-voltage components to get sparkover to his body or hands, does not have to worry about X-rays since he is usually far enough from their source or well enough protected from their source (by shields, etc.) that he is in no danger.

REPLACE ALL CANS

4. When replacing a TV set in a cabinet, technicians should at all times replace all hardware, especially high-voltage cans, and safety glass to insure his customers against possible low dosages of X-rays as well as to provide the security these devices offer from shock hazards.

"The only tube (picture tube) that seemed a potential X-ray hazard other than the rectifiers was the 3in Philips projection tube, when used, and only when used outside its housing. This tube, remember, has a rather thin glass window, uses some 30,000 volts (which is definitely in the X-ray range), and its cathode is rather close to the screen (it being a short-neck tube). Be careful when using this tube.

"Unfortunately, I have not been able to obtain any X-ray measurements on colour TV tubes at this time. However, I intend to do this as soon as possible."

CHARLES R. MADUELL, Jun.
Consulting Physicist
New Orleans, La.

Well, that should provide something for those of our readers to chew on, who may have more than a passing inter-

I have seen which had very high voltages and also on the fact that colour television sets will have substantially higher voltages than black-and-white receivers.

"What I said was in the nature of a warning, telling people to be careful, particularly where children are concerned, that they do not put their faces too close to the receiving set (I recommend a distance of six feet from the set).

"It is my feeling that so little is known about both the short- and long-range effects of radiation that, when one is dealing with any instrument potentially dangerous in this area, extreme caution is always advisable. It is a caution I use with my own children and a caution a great many of my colleagues also use.

ANODE VOLTAGE

"I had been referring to an increase in the anode voltage and not the serviceman's low-power 'booster,' which, incidentally, I have on my own TV.

"I do not know how widely special glasses are used on commercial television receivers. I do know that one of the large manufacturers of the glass envelopes uses barium glass on the face of the viewing tube. This, however, is something that has been developed only in the last several years.

"I understand from this same manufacturer that a barium lead glass will be used on the colour glass envelopes he manufactures. The reason he gave me in both instances was that, while most information to date would seem to indicate that the radiation of a television viewing tube is quite low, he would rather be sure than make a dangerous mistake.

"The plate, glass which is usually in front of the tube is of the same composition as that found in ordinary windows."

JAMES B. KELLEY

Consultant.

Technical Industrial Research

So ran Doctor Kelley's letter. It prompted correspondence from another Consulting Physicist, who apparently made it his business to investigate the matter at first hand. His findings should be of some comfort to those who have had misgivings about X-rays from receivers in current local use:

FINDINGS ON X-RAYS

Dear Editor:

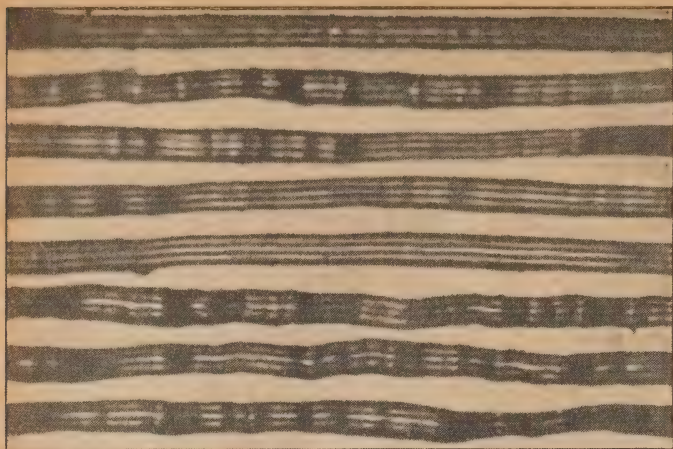
"Hot Words on Boosters' (page 16, October issue) hit a point close to home. Therefore, I am writing this to correct what seems a gross misunderstanding of a rather vague subject.

"Since I am a radiation physicist, one of the very first things I found myself doing was measuring the X-rays that emanate from picture tubes and other high-voltage tubes to find out if they would be strong enough to be harmful.

"Using a Victorian R-meter, which is commonly used in X-ray laboratories for measuring X-ray strength, I empirically determined that very little radiation emanated from the face of a TV picture tube. So little, in fact, that the readings were barely indicated on the R-meter.

"With the TV set in the cabinet, no reading was available, indicating that the strength of X-rays was way below the sensitivity of the meter.

"Around the neck of the picture tube, where the glass is rather thin, a definite



An enlargement of a 78 shellac disc cut in 1933 with a combined vertical/lateral cutting head. Notice the varying width of the grooves under heavy modulation. Today's methods produce much cleaner grooves than these, but the photograph serves to illustrate the principle.

Stereo Recording With Single Grooves

Stereophonic disc recording is a prospect for the immediate future. Not so long ago, during the Audio Engineering Society's convention in New York City, two systems of stereophonic disc recording—both using a single groove and single stylus—were demonstrated. Comments of manufacturers and engineers left little doubt that commercially practical disc stereo has arrived, and it is confidently expected that major record manufacturers on both sides of the Atlantic will start producing stereo discs this year. This article, by arrangement with Radio-Electronics, gives an excellent description of the two major stereo methods now being considered by the industry.

THE question most often asked when the possibility of a new stereophonic system of disc recording is mentioned is "Does it use one or two styli?"

Often surprise is expressed that it should be possible to use a system with only one stylus.

Of course the Cook "binaural" record has been available for some time. It uses two pickups spaced a certain distance apart, so each plays a separate section of the record.

TROUBLES WITH TWIN TRACKS

But many people seem to visualise two styli quite close together and probably in the same pickup, either playing adjacent grooves or following each other in the same groove.

This idea probably arises from the present systems of stereophonic tape which employ two tracks and consequently require two playback heads.

Systems for stereo on tape have been suggested employing magnetisation at different angles on only one track. Sepa-

rate playback heads, mounted at the correct angle for the program information in each channel, could then play the same magnetic track (Fig. 1).

But disc is quite a different proposition. For one thing there would be the difficulty of making sure that each stylus is in the correct groove.

If the arm and head of the pickup are mounted correctly so the styli are theoretically in line with the groove at all positions across the record the compliance of any modern pickup must be so large that the stylus can move a distance representing several grooves without appreciable opposition.

Consequently it would still be very easy to lower the pickup in such a way that the two styli would settle in grooves two or three rotations apart instead of in the same groove. In fact, it would be

come difficult to lower the pickup so that the two styli would rest in the same groove—and even more difficult to lower them so they rested correctly in adjacent grooves, if such a system should be used.

The great prospective advantage of stereophonic recording on disc is that it will be as easy to play as LPs are today. Consequently an arrangement that involves great precision in lowering the pickup to the record would invalidate its advantage. It would become no easier to handle than tape.

So the only prospective system for stereophony on disc that represents an economic and utilitarian advantage is one where a single stylus is used.

VERTICAL-LATERAL

The idea of using vertical-lateral recording is not new. It has been experimented with for a long time, and good pickups for the purpose were developed in the 30s. At the moment two completely different systems, both using vertical and lateral movement of the stylus, are being proposed for high-fidelity reproduction of stereophonic sound.

One comes from England (the London Record Co.), employing vertical for one channel and lateral for the other channel of stereophonic sound. The second is a system recently developed by Westrex which employs 45 degrees movement one way for one channel and 45 degrees movement at right angles to the first for the other channel. This new system claims several advantages over the vertical-lateral system. Whether these advantages are real or theoretical remains to be proved.

One question encountered with both should first be resolved. When any system of moving the stylus both vertically and laterally is discussed someone invariably asks won't it be difficult to press recordings of this type. The implication seems to be that it must involve some undercutting in the groove walls.

The argument usually begins "If the stylus moves sideways when it is at the bottom of a vertical cut..."

NO UNDERCUTTING

In answer to this, note that both vertical and lateral recordings use a cutter and stylus whose disposition to the record is vertical (Fig. 2). When the same cutter is used to cut vertical and lateral, or the same stylus to play it back, it is still vertical. So there can be no undercutting at any point.

In fact, London Records has pressed a quantity of these recordings in their standard machines used for LPs, and demonstrations were given with these pressings. We are assured that stereo discs need cost no more for the same playing time than LPs. This, surely, is the economic answer for stereo.

To explain the principle on which these systems work Fig. 3 shows a simplified arrangement for a magnetic pickup (or cutter) for use on each. In the vertical-lateral (London) (Fig. 3a) vertical motion of the armature attached to the stylus alters the magnetic field between the vertical pole pieces and produces vertical output from these coils. But the movement is parallel to the lateral pole pieces and thus produces no output. For lateral movement the reverse is true.

The so-called 45/45 (Westrex) works in exactly the same way by rotating the pole-piece portion through 45 degrees

By Norman Crowhurst

Fig. 3b). Each 45 degrees motion is at 1 degrees to the other, so the same paration of outputs works just the same.

Obviously the physical arrangement own in Fig. 3 could not be used because the stylus could never touch the cord in the position shown—the magnetic assembly would get in the way. These are simplified drawings to show how it works. Nor is the principle limited to magnetic pickups. The same paration can be achieved with moving-coil, crystal, capacitance, etc., or with combinations of them.

The first and biggest advantage claimed for the 45/45 is that vertical recording has always been accompanied by a greater amount of distortion than lateral recording. This is because depression of the cutter requires a greater force than lifting it. Because of the triangular shape of the cutter depressing it, say, 1 mil, increases the amount of record material removed by much more than lifting it by 1 mil reduces the quantity removed (Fig. 4). Force required is approximately proportional to material removed. Consequently, vertical recording (or hill-and-dale, as it was called in old days) is accompanied by second-harmonic and similar forms of distortion.

INHERENT DISTORTION

For a long while this has been the reason given for the preference for lateral recording where the cutter removes a constant amount of material from the master disc, and consequently there is no inherent distortion in the cutting operation. The argument for 45/45 is that both movements involve the same proportion of vertical and lateral components (Fig. 5); consequently the quality is equal on both channels. The distortion contributed by the vertical component is not all on one channel but distributed equally between both channels.

The second claim for 45/45 is that it gives better compatibility both ways. Before going any further let's define a little more precisely what we mean by compatibility. Complete compatibility would mean the system is capable of the following combinations:

1. A new type stereo pickup should be able to play and give satisfactory reproduction from an L.P. record recorded nonstereo, and
2. A nonstereo pickup and single-channel high-fidelity system should be able to play the new stereo disc with quality equivalent to reproduction from a good L.P.

COMPATIBILITY

Compatibility in the first sense is achieved by either system. The second sense involves two further considerations. If it is possible to play the stereo disc with a nonstereo pickup and achieve high-fidelity reproduction, it would seem that the record manufacturer does not have to put out two types of discs for the same program. But there is another factor.

If the stereo disc is played with an L.P. type pickup, it may give satisfactory high-fidelity reproduction but still ruin the stereo disc for subsequent playing on a stereo pickup. The great majority of high-fidelity pickups today have much less vertical than horizontal compliance.

In fact, one well-known pickup, having a reputation among the best, has virtually zero vertical compliance.

If such a pickup were used to play

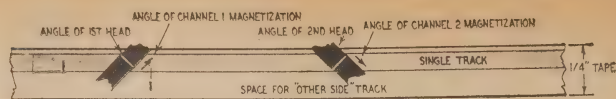


Fig. 1. A method by which two-channel stereo might be put on a single tape track.

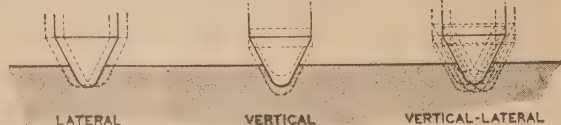


Fig. 2. In lateral recording the stylus moves sideways; in vertical recording up and down. Vertical-lateral moves it in all directions.

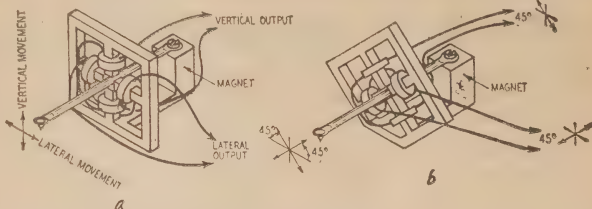


Fig. 3. Simplified arrangement for stereo magnetic pickups: a—London method; b—Westrex method.

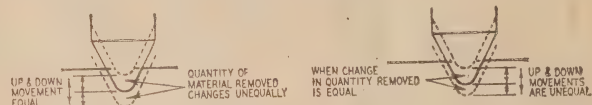


Fig. 4. The reason for greater distortion problems with vertical recording.

any stereo disc, it would completely wreck the vertical component of the stereo recording and the disc would then become useless for playing as anything but an L.P.

While the hi-fi pickup would plough out most of the vertical material, it would not completely eliminate it. Consequently, whether vertical-lateral or 45/45 is used, if this disc were subsequently played on its appropriate stereo system it would sound extremely distorted because of the damage to the vertical component.

In a vertical-lateral recording one channel would get all the distortion, which the other would remain at its normal high fidelity. But with a 45/45 recording, both channels would be equally distorted.

Either way—and this is the vital factor about whether compatibility should be claimed by either system—the user is scarcely likely to blame his trusted high-fidelity pickup for the damage. He is much more likely to conclude either that the record was no good in the first place or that his stereo pickup is no good, and thereby form a bad initial impression of the system.

INTERCHANGE OF PICKUPS

For this reason, it would seem advantageous, whichever system is used, not to make any endeavour to claim the second form of compatibility. In their own interests, the record companies should continue to issue both types of recording, whichever system of stereo disc is ultimately chosen.

The man who goes for stereo disc will buy a stereo pickup and, thereafter, because of its compatibility in the first sense, he will be able to play this mon-

aural L.P.s with his stereo pickup. This is possible with both systems.

Further, it seems that with either system the user should be advised to keep his stereo disc to be played only with a stereo pickup and should be warned that any nonstereo high-fidelity pickup is likely to ruin the record.

It's true that some hi-fi pickups may not ruin the record if they happen to have a high vertical compliance. But high vertical compliance is not inherently connected with the quality of an L.P. pickup. Consequently, it would not seem advisable to differentiate between high-quality L.P. pickups with and without high vertical compliance. This will only be something that would confuse the consumer still further.

COMPARATIVE DISTORTION

It would be best to play safe and recommend that stereo discs be played only with a stereo pickup, adding the warning that an ordinary pickup, which may give satisfactory high-fidelity reproduction, is likely to ruin the disc for playing over a stereo system.

Having settled (I hope) this question, let's investigate the comparative merits of vertical-lateral or 45/45, playing as a stereophonic system. First, let's look into this matter of distortion.

The implication has been made that the 45/45 distributes the distortion equally between both channels. This tacitly assumes the vertical distortion is inevitable. "So we have to live with it, let's make the best of it," by putting it equally in both channels instead of having it all in one.

This seems a rather unsatisfactory attitude in view of the fact that stereophonic reproduction is intended to be a

MAGNETIC SOUND INDUSTRIES



Nothing But TAPE RECORDERS from £65 or £10 dep.

Only Magnetic Industries can offer you tape recorders from this amazingly low price. And not only is the price right, but we have the largest range of tape recorders in Australia. EVERY machine we sell, brand new or reconditioned, carries our full UNCONDITIONAL GUARANTEE.



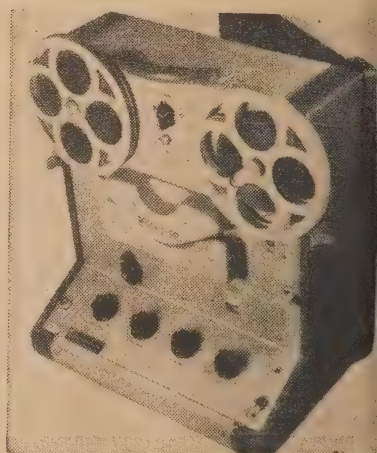
FIRST RELEASE: NEW WALTERS TAPE RECORDER

£79/10/-

De-luxe model
£89/10/-

It's brand new and exclusive to Magnetic Sound Industries. The Walters is all British made and the least expensive tape recorder ever. Weighs only 19lb. frequency response 40-10,000 cycles, 1 1/2

hours playing. It features a large inbuilt loudspeaker, single knob operation for added simplicity and a smart 2-tone carrying case. Ideal for music or speech, records from radio or microphone. Only £79/10/-.



TECNICORDA

SEMI-PROFESSIONAL HIGH FIDELITY MODEL UG4

Frequency range of 50-1200 cps, 3 motors, in-built mixing control. Carries our exclusive 12 MONTH GUARANTEE. £149/2/-, Free Microphone stand

NEW RELEASE, LATEST MODEL UG666

This long awaited Tecnicorda model is now at Magnetic Sound Industries. Beautifully compact, light and easy to carry. 2 speeds, 3 motors, the best buy in home recorders. 114 gns, 12 MONTH GUARANTEE. Free Microphone stand.

HI-FI from only 27/6 deposit

See and hear for yourself the finest range of high fidelity equipment in Australia! Take advantage of the exclusive 'COMPARATOR WAY' of comparing every worthwhile amplifier, pickup and loudspeaker. This unique system enables you to choose from over 200 combinations of equipment. See and hear this equipment in our spacious, beautifully appointed air conditioned showroom in the heart of the city.

WE SELL, SERVICE, HIRE AND BUY GOOD TAPE RECORDERS

MAGNETIC SOUND

INDUSTRIES
(AUST.)

STREET LEVEL, BISLEY HOUSE, 387 GEORGE STREET. PHONE BX4440 or BX4587.

step forward from high fidelity. In high fidelity we have worked hard to eliminate or minimise all possible causes of distortion. So it seems to be a retrogressive step to provide two-channel recording at the cost of accepting a greater amount of distortion than we would tolerate with a single-channel system.

The question arises, "Do we really have to put up with all this distortion on vertical recording?" The idea that distortion is inherent to vertical recording dates from the days before feedback cutters were invented. Any attempt to produce vertical-lateral recordings with a "straight" cutter, without the use of feedback, would undoubtedly involve considerably more distortion in the vertical than in the lateral cut.

If this was applied to a two-channel system, with the lateral for one channel and the vertical for the other, the vertical channel would have much more distortion than the lateral channel.

FEEDBACK CUTTERS

Whether such a cutter or one designed for the purpose were employed to produce the 45/45 system, both channels would have much more distortion than LPs using the simple lateral type of cut.

Fortunately, some very good feedback cutters have been developed, and a recent demonstration given by London Records for the benefit of the industry, using the vertical-lateral arrangement, proved that it is possible to record vertically with as high a quality as laterally. This particular recording made claims of going no higher than 12,000 cycles. But neither did the lateral.

The important thing here is that distortion in the vertical was no higher than distortion in the lateral, due to the excellent compensation by the feedback cutter.

This, then, eliminates the distortion comparison issue from the relative merits of the two systems. So we are left with three more factors to consider. One is the claim of compatibility already mentioned. The other two are the possible problems involved in achieving an adequate cross-talk ratio, and a space utilisation factor of the record material itself, which will involve the relationship between playing length and dynamic range that can be achieved as compared with the regular LP.

PROGRAM CHASING

There are two possibilities about the phasing of program material in the 45/45 system (Fig. 6). These principally affect the low frequencies which are responsible for the greater amplitude movement of the stylus in both directions.

If the phasing is such that a signal on both channels that would result in an ultimate push forward on both loud-speaker diaphragms moves the stylus to the left, one channel's signal moving it up and the other down at the same time, this combination will result in a lateral movement to the left, the next half-cycle moving it to the right.

We can call this a lateral-dominant movement.

Changing the phase of one of the cutters will make the same in-phase combination from the microphones move the stylus up and down—in other words, a vertical-dominant movement. A lateral movement in this case would correspond with pressure at one microphone and rarefaction at the other, or in playback would result in one speaker pushing when the other pulls.

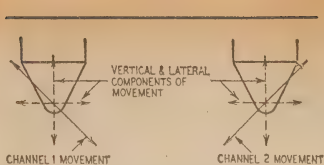


Fig. 5. Use of 45/45, as shown here, makes each channel use a combination of vertical-lateral.

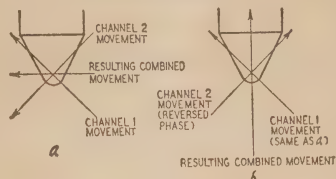


Fig. 6. Two possible ways of phasing stereo program in 45/45 system: a—dominantly lateral; B—dominantly vertically.



Fig. 7.—a Provided axes of movement are at precisely 45 degrees in the cutter, cross-talk will be limited only by how well the cutter and pickup are made;—distortion of these axes (dashed lines) at some stage of the process will cause increased cross-talk.

This phasing can result in certain economies in groove spacing, but has disadvantages from the compatibility point of view. Playing an ordinary LP with a 45/45 stereo pickup so hooked up would result in the speakers being out of phase, which produces a rather unpleasant kind of reproduction.

If the vertical-dominant connection were selected for the 45/45 system as a standard, the system would be compatible for playing LPs only by arranging a phase changeover switch in one channel.

The vertical-lateral system is also compatible. If the stereo pickup is used to play an LP disc without changing connections in any way, the whole program will seem to come from one speaker. This is, of course, obvious to the user, and it is a simple matter to provide this system with a paralleling switch to feed the output from the lateral coils of the pickup to the input of both channels. This would enable both speakers to get the same program in phase.

CROSS TALK

The question of possible cross-talk is one that ties in with two other factors: the way the recording is made (that is, the kind of microphone placement and combination used), and the results of future developments in cutters and pickups which, at the present stage, are difficult to predict.

It would seem at present that it would be simpler to provide precision isolation between two movements at 90 degrees to one another when one of these is vertical and the other lateral, than when both are at an angle. Deviation of either

angle of movement from a perfect 45 degree will result in some break-through on to the other channel's sound because the two movements will no longer be at exactly 90 degrees to one another.

Academically, of course, both methods are equally possible of as good separation. But mechanically it seems that the vertical-lateral arrangement would offer less problems in manufacture and also offer the greater potential for future development in cutter and pickup design. If anything at all should distort the vertical-lateral proportions of the recording during processing, this would produce deterioration as cross-talk (Fig. 7).

As against this, the claim for the 45/45 in this respect can be based on the use of symmetry—the fact that the two drives can be arranged in symmetrical manner, like a V-8 motor, which is not so readily possible with a vertical and lateral arrangement.

London Records demonstrated with a pickup whose cross-talk was reputed to be 25 db and they reported that a prototype has just been developed that gives a cross-talk ratio of 35 db, which is more than adequate and would seem to allow plenty for production deviation.

In the initial development stage, the crystal transducer did not produce as good a cross-talk ratio as the other types, but it was still adequate for use in a low-cost stereophonic disc system—a very important consideration for the mass market.

The tape people lay claim to the potential for highest possible quality because their playback heads have no moving parts. Of course, they have magnetic circuits which can introduce their own troubles. But pickups have moving parts which make it more difficult to produce a uniform frequency characteristic. So, basically, it would seem that tape stereo offers the best possibility for those really interested in absolute top quality—a view that is underscored by the fact that, at present, all master recordings are made on tape, later to be dubbed on disc.

OBVIOUS SIMPLICITY

The obvious advantage of the stereo disc is its simplicity in use. It can be handled exactly the same as the present LPs. If a visitor steps in and you want to impress him with your latest recording, you can lower the stylus on to the particular passage you want to play, and then, if he is further interested, play the whole disc. This is quite difficult with tapes because you cannot find the particular spot in a recording as quickly.

This and the ease of putting the stylus on the record and taking it off again will presumably result in greater popularity of stereo disc with the mass market. In fact, I would go for stereo disc in preference to tape myself, for the same reason. This being the case, we have to consider not only the possibility, but the very high probability, that stereo discs will be applied in the extremely low price range, comparable with present record players. At the same time, it should be possible to produce at an economical price a system having quality comparable with the best LP re-producers.

The final matter for comparison is the space factor. With both the London and Westrex systems, maximum groove width is greater than on standard LPs.

HI-FI IN YOUR HOME COSTS LESS THAN YOU THINK

Decide right now to enjoy the wonderful advantages of Hi-Fi in your home. Hi-Fi, when you construct it yourself, from components bought from Modular can cost you a minimum. You'll benefit too from the knowledge of two of Australia's foremost Hi-Fi experts who will be only too pleased to advise you on how to get started in Hi-Fi, or how to improve your present set. John Breakspear and Gordon Davies are always on hand to steer you right on any problem, naturally this puts you under no obligation to buy, it's just a professional service extended to those who have learned to appreciate the beauty of high fidelity.

SPECIAL SERVICE TO COUNTRY CLIENTS

Write for catalogues on Hi-Fi units and components, you can be assured of personal and efficient attention. Write direct for any Hi-Fi components

or sets you may require. Write for any information concerning high fidelity, another service of the specialists.

EVERYTHING FOR THE HI-FI ENTHUSIAST—ALL UNDER ONE ROOF!

From the shop and auditorium with its lavish wall-to-wall carpeting, acoustic sound-proofing and modern fittings to Modular's own workshop and testing laboratory . . .

there's the one combined service that is designed to overcome your Hi-Fi problems or to get you started in Hi-Fi. Remember this—you're definitely under no obligation to buy.

BUY YOUR RECORDS UNDER HI-FI CONDITIONS

Another service which Modular offers is a record bar where you can buy and be advised of the best records to enable you to enjoy Hi-Fi under the most pleasant conditions. It costs no more to buy from Modular so why not enjoy this service from right now.

STOCKISTS OF THE BEST HI-FI COMPONENTS!

AMPLIFIERS

Modular
Quad
Leak
Armstrong
Grampian
Aegis

LOUDSPEAKERS

Wharfedale
Goodmans
Philips
Jensen
Peerless
Rola
and others.

RECORD PLAYER & PICKUPS

Philips
M.B.H.
Elac
Dual
Collaro
Garrard
Goldring
Leak
Thorens

24 HOURS' SERVICE

RING NOW XJ5928 or after hours at the same number. Modular Electronics is at your service day and night, they will be pleased to answer your problems if you ring or call personally. Contact Modular Electronics now and learn of the newest advances in Hi-Fi.

MODULAR

E L E C T R O N I C S

579 SYDNEY RD.,
SEAFORTH. XJ5928

(Just down from the Seaforth Post Office).

This greater width is caused by the need for the cutter to go deeper into the record to record the vertical component properly. As the cutter is chisel-shaped, the deeper it goes the wider the groove.

In theory, the modulation area for the 45/45 is the same square cross-section of possible movement as for the vertical-lateral, but it is turned up on its corner so that room has to be found in the material of the disc for a spiral modulation area of square section wound corner-on, as it were. This results in less economical utilisation of the record material than for a spiral wound so the flat surfaces of the modulation area lay one beside the other.

But there is another factor that brings up two possibilities. If the in-phase components result in lateral movement the out-of-phase components, which will invariably be considerably smaller in amplitude, will result in less demand on the vertical excursion of the cutter and playback stylus. This enables the unwanted distortion we mentioned earlier—and which may well be only of academic interest at this stage—to be minimised.

STYLUS MOVEMENT

On the other hand, if the in-phase operation produces a vertical resultant, the principal movement of the stylus with a 45/45 system now becomes vertical and the grooves can be cut much closer together, allowing a longer amount of program material to be squeezed into the same space but requiring much deeper vertical cut. This may either result in greater distortion or, by reducing the vertical excursion permitted, will considerably reduce dynamic range.

So, on the score of both compatibility and dynamic range, the 45/45 should be phased so in-phase program produces lateral-dominant movement. This is, in fact, the phasing standardised by Westrex in their system.

A further factor that should be mentioned before we leave this subject is the effect of recording techniques. Systems developed in Europe independently, the Stereosonic and the German MS systems, both employ dominantly intensity differences in the program content of the two channels rather than time differences which are more dominant in most American stereophonic recordings.

CHANNELS ARE BALANCED

A possible advantage of the intensity-dominant channel differences is that it makes cross-talk relatively unimportant as both channels contain exactly the same program information at the same time, but with different proportions of it in each channel for different sections of the orchestra. Thus the only effect of possible breakthrough is that the directional effects intended will be slightly modified. There will be no undesirable echo or distortion products due to inter-modulation from one channel to the other, such as can occur where there are time differences as well as intensity differences.

An adaptation of these recording techniques might utilise a vertical-lateral arrangement, with wide-range lateral and limited-fidelity vertical. This would offer additional possibilities for rumble reduction with low-quality turntables.

The London people, however, adopt the attitude that, in view of the improved quality in the vertical channel they have already succeeded in achieving

on a production basis, this is an unnecessary limitation on the medium. Without such a limitation it is possible to provide flexibility so that both channels can contain stereophonic information with either intensity or time differences equally well.

Sometimes stereophonic recordings deliberately contain out-of-phase components in the low and middle frequencies to get specific effects that are not obtainable with simple single-channel LP presentation. Use of a modified stereophonic or MS system would preclude this type of presentation and other possibilities of exploiting the new stereophonic medium to the utmost. Consequently it is good to see that the vertical-lateral presentation has achieved a standard of recording and reproduction such that two high-quality channels can be provided.

The next question is shall we have both systems or only one, and, if so, which one. This is a matter for the record industry to decide. Obviously it is impractical to use both systems because, although each is compatible with single-channel LPs in its own way,

neither is compatible with the other without a conversion switch to sum-and-difference combination to convert the output from the pickup from one form to the other. It would be impractical to use such a system as this because the user would never know which kind of disc he had and whether he was playing it correctly.

Consequently it would seem vital to select one system or the other and make this the standard for the industry. (Proponents of both systems agree that it is unthinkable that two incompatible systems should co-exist, and it is likely that they will agree on one of the systems before starting to make stereo discs.) From the foregoing discussion it is evident that both systems have their possibilities and probably the decision will rest on the technique developed so far with each system and the quality it produces. This does not say the system with the inherent best possibilities will win. More likely it will be the one whose technological development at the time the decision is made has reached a higher order.

For the finest in Sound

BRAMCO

HI-FI TRANSFORMERS

Available from:—

ALL LEADING DISTRIBUTORS

FOR

TRUVOX

**Tape Decks
Tape Recorders
Stereophonic Heads**

BRADMATIC

**Tape Decks
Recording Heads
Miniature and Standard**

THE

TAPERITER

**Office
Dictating
Machine**

CONTACT

ELECTRONICS AUST. PTY. LTD.

FACTORY AREA WELSHPOOL

OR

**L. G. WALKER & Co. 243 ELIZABETH ST.,
SYDNEY PHONE BM6149**

AIR PRESSURE GAUGES £1

0-220 lbs. ins.
Post N.S.W., 2/1. Int., 3/3.

AIR COMPRESSOR UNIT

with Oil Trap and Air Hose New.

£3/10/-

Post N.S.W., 6/5. Int., 9/6.

RANGE FINDERS

Horizon and Bubble Type, Brand new Mark IIIB.

Complete with Leather Case.

Dimensions, 9in x 4in x 2in.

Ex-R.A.A.F. ORIGINAL COST

£30.

PRICE 35/-

Post N.S.W., 3/2. Interstate, 4/7.

RANGEFINDERS

BARR AND STROUD

(Tubular) Mk. III.

Reads up to 20,000 yards.

£9/17/6

Freight payable at nearest attended railway station.

RANGEFINDERS

T. COOKE AND SONS.

Mk. III. Reads up to 26,000 yds.

£12/10/- ea.

Freight payable at nearest attended railway station.

CONDENSERS

Point 01 9/- doz.

400 Mfd. 12 PV. 1/3 ea.

Block Condenser, bakelite.

Point 01 MF750 volts D.C. 12/ doz.

Add postage.

No. 19 TRANSCEIVERS

(2-way Radio) with Genemotor.

and 15 standard valves

£7/10/-

Freight payable at nearest attended railway station.

Telescopes, Brand New

30-POWER Coated lenses.

£5 15/- Post N.S.W., 4/5

Int., 5/10.

TELESCOPES

Ex-Army

Optics of London

With variable power adjustments.

Length 26in. Weight 12lb.

£12/10/-

Freight payable at nearest attended railway station.

OIL PRESSURE GAUGES

New, Suit. Cars, Trucks, Boats.

Stationary Motors, etc.

0-150 lbs./sq. ins.

£1 ea.

Complete with Tubing.

Post N.S.W., 2/1. Int., 3/3.

GENERATOR

24 volt D.C., Ex. R.A.A.F.

100 Amps

£17/10/-

Freight payable at nearest attended railway station.

AIRCRAFT MAGNETS

Contains sundry rears. Coil, Electrical and mechanical parts.

Only 9/6 ea.

Freight payable at nearest attended railway station.

MOTOR

240 volt A.C. 1.6 h.p., 1500 revs., 50 cycle, single phase tested

£7/19/6

Freight payable at nearest attended railway station.

ALTIMETERS

BRAND NEW

£1 ea.

Post N.S.W., 2/1. Int., 3/3.

AIR SPEED INDICATORS

New.

£1

Post N.S.W., 2/1. Int., 3/3.



P8 COMPASS

RECONDITIONED AS NEW Liquid Filled, Ex-R.A.A.F., 4in diameter, Cost £35. Ideal for small boats, etc.

Special price

£3/15/- ea.

Post N.S.W., 5/2. Int., 7/6.

CATHODE RAY TUBE

Type 4/1 with Socket

New

29/6 ea.

Post N.S.W., 2/6

Interstate 3/11

PURE LINEN PLASTICISED COVERS

Ex-R.A.A.F. brand new, 100 per cent waterproof, 19 x 12, suit Holden, Zephyr, Vauxhall, etc. Cost £40. Our Price

£7/19/6

Post N.S.W., 6/5.

Int., 9/6.

LEVELS

with high-power telescope.

Will do dumpy work.

Cost £300. Special £15 each.

VERNIER DIALS new

(RADIO)

19/6

Post N.S.W., 2/6. Int., 3/11

MANIFOLD PRESSURE GAUGES

NEW £1

Post N.S.W., 2/1. Int., 3/3.

AMERICAN FIBRE PULLEYS

with good quality ball bearing

1 3/8 diam. 1/4 Shaft. 2/6

1 3/4 diam. 3/4 Shaft. 3/6

2 3/8in diam. 3/8 Shaft. 4/6

3 1/2 in diam. 3/8 Shaft. 5/6

Add postage.

HANDSETS TELEPHONE

With Pressel switch, Brand New

25/-

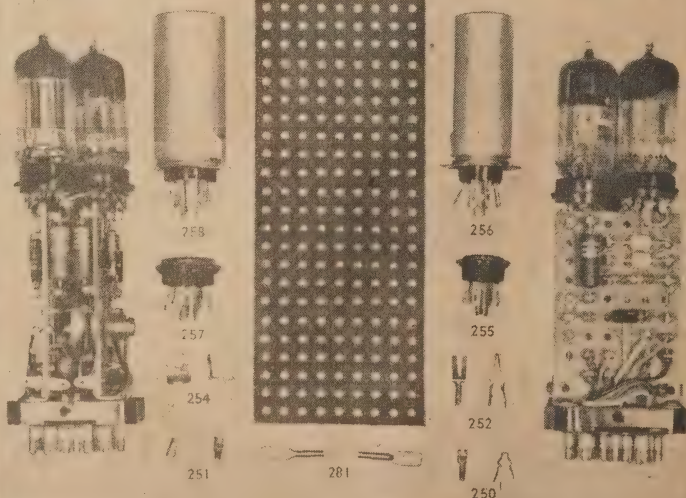
Post N.S.W., 2/1. Int., 3/3.

DEITCH BROS.

70 OXFORD STREET, SYDNEY Between Crown and Riley Streets, City.

Reduce the size and cost of your New Equipment by using

TYPICAL
UNITS
using
ZEPHYR
MATRIX
SYSTEM



Leaflets and price list available from all leading Wholesalers.

Enquiries invited from manufacturers.

ZEPHYR PRODUCTS PTY. LTD.

58 HIGH STREET, GLEN IRIS. S.E. 6. VICTORIA.

PHONE: BL1300

TRADE REVIEWS AND RELEASES

IBBOTT TWEETER HAS ALL-ROUND LOOK

An interesting new tweeter speaker has recently been released by the Ibbott Company, of 430 Bourke St., Melbourne. Employing a crystal drive unit, it radiates through a full 360-degree angle in the horizontal plane for good sound diffusion.

On test, this wide dispersion of the higher frequencies is most evident, and, with the tweeter resting on top of the main speaker enclosure, it is possible to hear the treble to full advantage anywhere in the listening room.

The tweeter is quite decorative in appearance, and is supplied with several feet of thin, twisted flex. It has a felt base and is intended to sit on top of an existing cabinet, without any further mounting provision. It presents no mechanical problems, therefore.

Beneath the assembly, inside the felt base ring is a small switch, allowing the tweeter to be set for 2, 8 or 15 ohms input. Acoustic output is controllable by a knob at the top.

As an accessory, the makers can supply a simple crossover network which can be cut into the voice coil circuit of existing equipment. It is marked "input," "hi," and "lo," the speakers being connected accordingly.

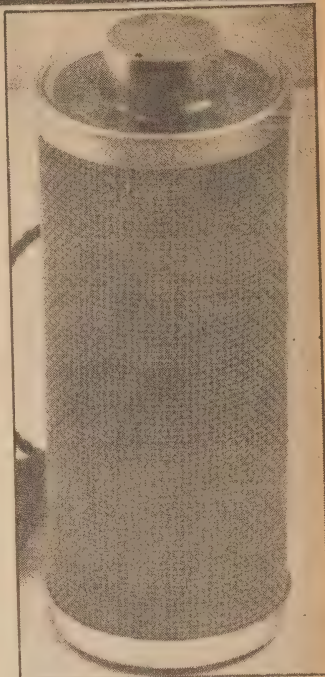
By way of experiment, we connected the tweeter and crossover network into the voice coil circuit of a television receiver, standing the tweeter on top of the cabinet. On live program material, the contribution to high frequency response was most marked, the control allowing the tweeter level to be set for best total balance.

Sensitivity of the tweeter is ample for such applications and subsequent tests indicated that it could also hold its own in this respect with higher grade imported speakers, other than perhaps the very sensitive types. Even so, the manufacturers claim that the total high frequency output is greater than might be thought at first listening, because it is dispersed and not confined to a narrow high-intensity beam, as is so often the case with other types.

Fed directly from the amplifier for purposes of test, the tweeter appears to give a substantially smooth output over its intended range. In the sample unit, there was a suggestion of a rise about 4.5 Kc and again about 8.5, with a quite sharp roll-off beyond 14 Kc.

With a full-scale divider network and with the control set for best balance, reproduction from the tweeter sounded quite smooth and clean. When used with the maker's simplified network, however, total output around 5 Kc was too high for really good balance.

Since the simple network in question uses electrolytic capacitors, some variation in crossover is to be expected. This may dictate the use of a more elaborate network for other than simple installations.



The Ibbott tweeter has the rather novel feature of omni-directional radiation for high frequency dispersal.

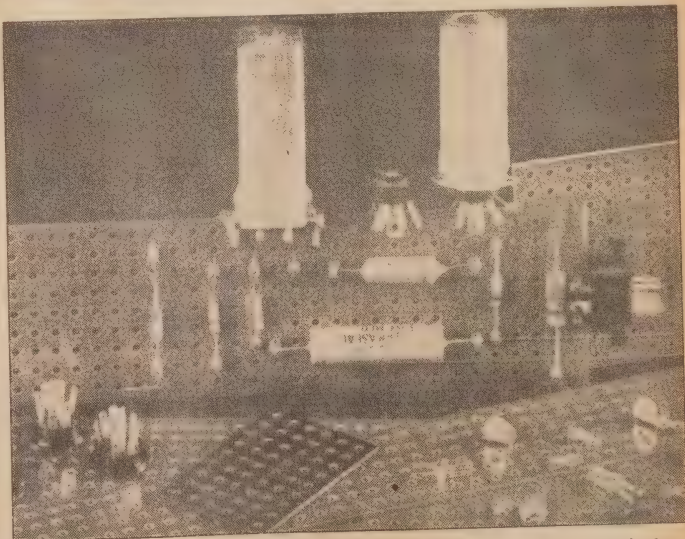
MATRIX BOARD ASSEMBLY SYSTEM

Zephyr Products Pty Ltd, of Glen Iris, Vic., are currently producing a matrix board wiring and assembly system which should have appeal in cases where it is desired to save time and costs on mechanical work.

The basis of the system is a perforated bakelite strip which is available in a variety of sizes and qualities. Different types of solder lugs which fit through the holes are available to suit different types of resistors and capacitors. For example, a long lug is available which allows components to be mounted either side of the bakelite.

Special valve sockets for mounting on the edge of the bakelite are available for both 9-pin and 7-pin miniature valves, both with and without shields. Right-angle lugs allow IF transformers, etc., to be mounted.

Samples of the various parts were supplied by Jacoby, Mitchell and Co Pty Ltd, of Sydney, from whom full price details are available. As an example, the retail price of the piece of high-grade bakelite, 9 holes wide and 12in long, is 11/2.



Our impression of the matrix system is that it would be valuable particularly for experimental units. It should also be excellent for permanent units involving transistors where all components are small and impedance levels low enough for shielding between successive stages to be unnecessary.

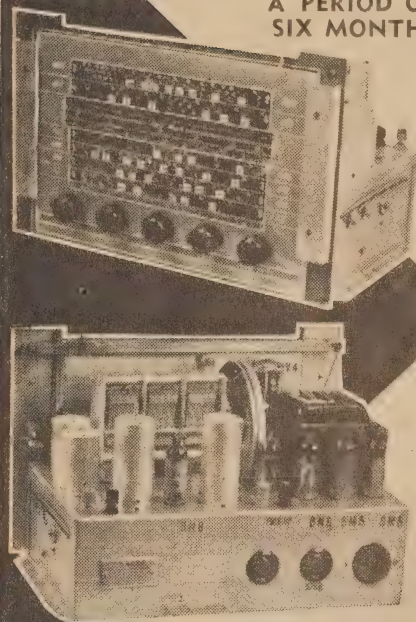
before purchasing your radio see our —

Hi-Fidelity

RANGE

and compare these NEW features..

**ALL CHASSIS
GUARANTEED FOR
A PERIOD OF
SIX MONTHS**



NEW SEVEN-VALVE HI-FI CHASSIS

This new compact dual wave seven-valve chassis uses the same tuner circuit as our 9-valve unit with the Mullard tone-control circuit giving separate bass and treble controls. Push-pull output using two of the new 6BM8 dual purpose output valves and heavy duty M.S.P. speaker.

£31/15/- F.O.R. PACKING 10/- EXTRA

Also available with Magnavox 12W.R. Hi-Fi speaker and Ferguson output transformer, at £4/15/- extra.

NEW :

Ultramodern circuit using nine high gain valves including "magic eye" tuning indicator. Permatuned iron cored coils and intermediates giving excellent inter state reception and a short wave range of 12,000 miles. All valves used are the new Mullard nine pin innova series.

NEW :

Tone control and audio stages incorporating the Mullard 5/10 amplifier circuit with separate bass and treble controls giving $\pm$ or $\pm$ 15 db. boost or cut at 50 cycles L.F. and 10,000 cycles H.F. combined with push-pull output with inverse feed-back gives you really high fidelity reproduction from your radio or favourite recordings.

NEW :

Dual Speaker combination using a heavy duty woofer (12in M.S.P. Jensen AU-54 special) with matching 6in tweeter and cross-over network giving a frequency response of 46 to 13,000 cycles. Speakers are mounted coaxially making only one 11in mounting hole necessary. If required the new Magnavox high-fidelity twin coned speaker can be supplied.

NEW :

Large calibrated edge-lit dial in plate glass (11in x 7in) with main stations of each State in prominent type. Dial fitted with counterweight drive, giving smooth tuning. Indicator lights are fitted showing which band is in operation. Dial can be supplied in cream, black or brown with matching knobs and escutcheon to suit contemporary blond or walnut finished cabinets.

NEW :

Sensitive "magic eye" tuning indicator (EM80) making tuning simple and positive even on interstate, overseas and country stations. All chassis are wired for the fitting of an F.M. tuner or tape recorder, special plug being provided on back of chassis. also pick-up terminals and outlet for gramophone motor. Power switch is fitted to volume control, radiogram switch, combined with wave change switch. Audio end of set can be used with TV receiver if required.

A NINE VALVE HIGH-FIDELITY RADIOGRAM CHASSIS

Nine and ten valve chassis incorporate the Mullard 5-10 AMPLIFIER CIRCUIT Frequency response 40-13,000 cycles. Max output 10 watts

£41'15'0

F.O.R.

A NEW 10 VALVE DUAL WAVE RADIOGRAM CHASSIS

WITH BASS AND TREBLE
BOOST

The ideal chassis for those difficult locations where reception is doubtful. Specifications as nine valve unit, but with the addition of high gain tuned R.F. stage giving greater sensitivity and selectivity on both broadcast and short wave bands

£44'15'0

F.O.R.

Write for full specifications

ALL 4 SPEED RECORD CHANGERS AND PLAYERS STOCKED.

Classic Radio

245 PARRAMATTA ROAD, HABERFIELD N.S.W. PHONE UA2145

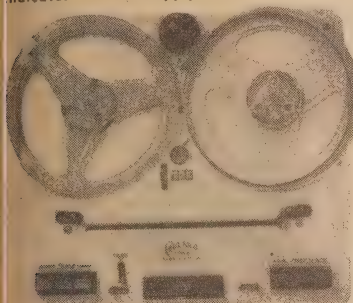
New Collaro High Fidelity Tape Recorder

Complete with Amplifier—Ready to switch on—

The Only Tape Deck with **ALL** these Features

MODEL MK III

All Decks Supplied Complete with five Valve Amplifier including Level Indicator Power Supply and Speaker.



Only Cabinet Required for Complete Recorder. Can be used in conjunction with Radiogram Chassis for Recorder-gram.

£69-15-0 F.O.R.

Also available as complete portable recorder—in attractive—and durable plastic covered cabinet with microphone 80 gns. F.O.R.

• HIGH FIDELITY

Heads are double coil wound and will reproduce up to 12,000 c.p.s. at 7 1/2 inches per second. Azimuth adjustments on both impedance "record" and "play-back" heads. Output of heads is approximately 5 milli-volts at 1 Kc at 7 1/2 inches per second

• INSTANTLY REVERSIBLE

Instantaneous changes can be made from one track to the other. Fast re-wind in either direction.

• CONSTANT TAPE TENSION

A special Collaro device ensures a constant tension on the tape on the take-up spool as it leaves the capstan.

• FULLY MECHANICAL

No solenoids are used in the construction of this Transcriptor. The braking is entirely mechanical.

• FINISH

Cream Polystyrene cover plate with maroon controls.

• THREE SPEEDS

3 3/4, 7 1/2 and 15 inches per second

• FOUR HEADS

Two "Record/Play-back" and two "Erase" heads are sited on two different levels and head wear thus halves for any given length of track.

• TWIN TRACK OPERATION

One pair of heads for each track. Both top and bottom tracks can be recorded or played back without removing tape

• PAUSE CONTROL

This has the effect of stopping the transit of the tape past the "Record/Play-back" and "Erase" heads and applying the brakes to the spools whilst leaving all switches and mechanical functions in their selected position. Typical application is to pause whilst recording to omit speech interposed between musical selections. Control will only work whilst it is held in position.

• TAPE MEASURING & CALIBRATING DEVICE

The three digit counter makes the location of any recorded passage the simplest of operations.

• TRANSCRIPTION TECHNIQUE

A large diameter flywheel with ground and lapped steel shaft running on a ball at the bottom of long bearing reduces friction and virtually eliminates "wow" and flutter to less than 0.15 of 1.0 per cent.

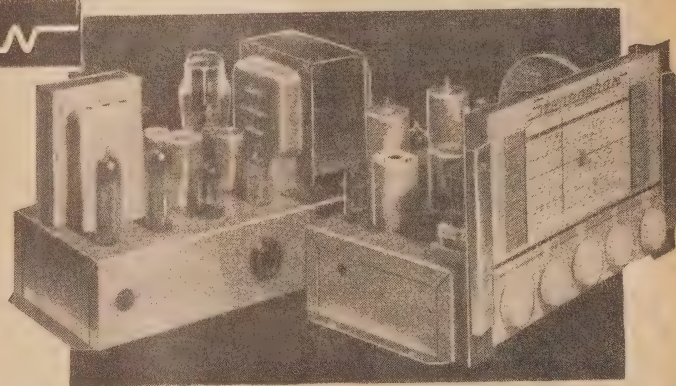
• TWO MOTORS

Each dynamically balanced motor does only one job at a time. Motors never act against each other and are of low wattage input with consequent reduction in heat and wear.

Stereophon

—LIVING SOUND—

A compact 11-Valve High-grade Radiogram in two chassis featuring a variable band with Tuner multi-input preamplifier and Tone Control in one unit and a 10-Watt Ultra-linear Amplifier. Ideally suited for use with High-grade Pick-ups and Speakers.



SUMMARY OF PERFORMANCE

TUNER: Broadcast Band. 4 position Bandwidth, whistle filter EM80 Tuning Indicator, attractive Dial.

PRE-AMPLIFIER: Microphone input sensitivity 1.5mV
Pick-up input 1 High sensitivity 5mV
2 Low sensitivity 50mV
Tape or TV input sensitivity 100mV
All inputs controlled by one 6-position functional switch
Power switch on Volume Control.

TONE CONTROL: Separate Bass and Treble Controls giving 20db boost to 18db cut for both controls.
R.I.A.A. Equalisation for L.P. and E.M.I. Equalisation for 78 records.

AMPLIFIER: 10 Watt Ultra-linear with Ferguson O.P. 301 Output transformer 6BQ5 output valves.

Frequency response 30-20,000 cycles + or - 0.5db.
Harmonic distortion better than 0.1 per cent.
Output impedance 15 ohms or as required.

QUALITY never
before at
this PRICE

65 GNS.

Classic Radio

245 PARRAMATTA ROAD, HABERFIELD, N.S.W. PHONE UA2145



TELEVISION COMPONENTS

BUILDING AN R.T. & H. TV SET?

If you intend building one of the R.T. & H. television receivers—5 INCH, 17 INCH, or 21 INCH—specify FERGUSON components, as used in the original models. Experienced constructors and TV Manufacturers, who insist on the best, all use FERGUSON components.

POWER TRANSFORMER PF1193

(FOR 5 INCH—17 INCH—21 INCH SETS)

PRIMARY—200, 220, 240V 50 cps

H.T. SEC.—295-0-295V 275 m.a.

L.T. SEC.—6.3V, tapped at 5V-3A
6.3V-9A

FEATURING—Low temperature rise—External copper shield—Low radiation field—Inversely connected H.T. winding—Suitable for either 5V or 6.3V filament rectifiers—Grey hammertone covers (laminations finished black)—Packed in strong carton—Full data sheet supplied.

FILTER CHOKE — CF388

(FOR 5 INCH—17 INCH—21 INCH SETS)

INDUCTANCE—1 Henry

D.C. CURRENT—275 m.a.

D.C. RESISTANCE—26 ohms

FEATURING—Full rated inductance at maximum current—Low resistance—Window clamps for electrical and mechanical stability—Effective internal lead anchoring, common to all FERGUSON components—Fully impregnated.

FILAMENT TRANSFORMER

2500V WORKING INSULATION

(FOR 5 INCH SET)

PF1290

PRIMARY—240V—50 cps
SECONDARY—6.3V—0.6A

PF1294

PRIMARY—240V—50 cps
SECONDARY—4V—1A

Available from all leading suppliers

DATA SHEETS ON THESE COMPONENTS AVAILABLE ON REQUEST

Manufactured by

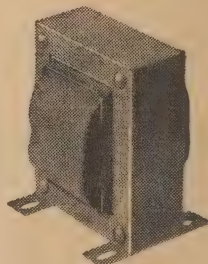
FERGUSON TRANSFORMERS PTY. LTD.

FERGUSON LANE, CHATSWOOD, N.S.W. JA8491

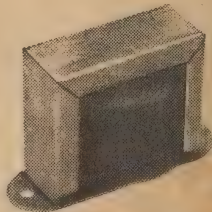
PF1193

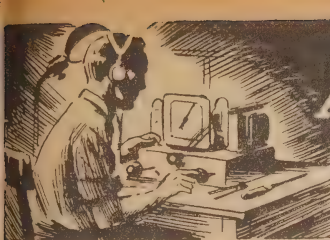


CF388



PF1290-PF1294





A READER BUILT IT!

Gadgets and circuits which we have not actually tried out, but published for the general interest of beginners and experimenters.

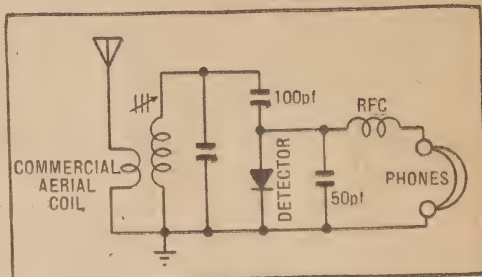
CRYSTAL CIRCUIT WITH FULLY ADJUSTABLE LOADING

A crystal receiver circuit which borrows an idea frequently used in amateur transmitters came to us from a reader in Western Australia. Impedance matching between the tuning coil and the detector diode can be adjusted continuously and over a wide range by means of a variable capacitor.

Our correspondent is a radio amateur from Western Australia and reports that he has received a good signal from a station 35 miles away using this circuit and a ferrite commercial coil.

Most crystal sets are equipped with a tapped tuning coil and best performance can be obtained by experimenting with the positions of the taps. For example, if the detector circuit is tapped across only a few turns of the coil little energy, relatively, will be extracted and the circuit will be able to exercise its normal selective function with little hindrance.

This novel crystal receiver circuit should be well worth trying. It uses a couple more components than most previous circuits but has worthwhile advantages.



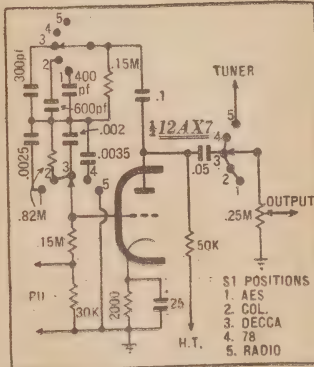
BEST EFFICIENCY

Since the crystal set depends for its operation entirely on energy extracted from the atmosphere, and this is extremely small, it follows that it must be carefully adjusted for best efficiency if good results are to be obtained.

This new circuit allows the effect of a variable tap to be obtained with a variable capacitor. Not only has this the advantage that a continuously variable "tap" can be obtained but an ordinary untapped commercial aerial coil can be used and the adjustment can be made from a panel knob.

Selectivity is best and volume least when the 100 μ F capacitor is at minimum and the reverse when the plates are fully meshed.

tone compensation circuit uses feedback



OVER the past seven years, we have described a number of control heads for "Playmaster" amplifiers including switching circuitry to compensate for various recording characteristics. The circuitry consists of resistors and capacitors forming the plate load of an amplifier valve, the values being chosen to attenuate various parts of the audio spectrum relative to others.

The circuit printed here achieves a similar result by using a selective feedback network over the preamplifier stage.

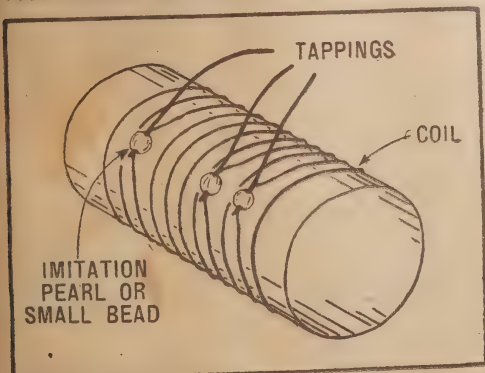
The negative feedback is made large at frequencies requiring small amplification and the reverse where full amplifications is required.

Many designers consider the scheme to have merit and circuits for preamplifiers using it have appeared in reputable overseas publications.

SELECTIVE FEEDBACK

The feedback voltage is taken from the plate of the valve via a large capacitor in order to block the DC component. Then comes the shaped feedback network proper through which the anti-phase voltage is applied to the grid.

Since the actual feedback factor is dependent on the load into which it looks, an isolating resistor (0.15 meg.) is included artificially to increase the source impedance. The value is large compared with the source impedance of the pickup in parallel with the 30,000 ohm resistor and therefore remains substantially constant with changes in pickup impedance. The load, incidentally can be changed over a very wide range to suit the particular pickup you happen to be using. Overall gain of the stage at mid frequencies is of the order of 1 according to our correspondent.



A reader from Villawood N.S.W. suggests using small beads to assist in making taps in tuning coils. The idea is to thread the beads on to the wire before starting to wind and then drop one wherever it is required to make the tap. It may even be possible to make solderless joints in an emergency by baring the wire and passing another piece through the hole.

SURVEY OF TUBELESS AMPLIFIERS

For as long as most of us can remember, the dream of amateur and engineer alike has been to have available an amplifier which does not require tubes — or valves — and their attendant power supplies. This article, reprinted by courtesy of the Aerovox Corporation, reviews the methods and progress in this field during recent years.

THE mention of the term tubeless amplifiers brings the immediate question, "Why is there interest in amplifiers which do not employ tubes?"

When vacuum tubes were both costly and fragile 35 years ago, there was a constant but fruitless search for other amplifying devices. But the quest was abandoned when tube prices became more reasonable and the product more dependable.

Interest in this direction has been revived in recent years because the tube often has proven to be the important unreliable link in complex electronic system chains.

PROMISE GREATER RELIABILITY

The non-tube amplifiers give promise of greatly increased reliability, especially since some of these devices have unlimited life. They don't use a filament or heater and thus make more efficient use of the local power.

A number of tubeless amplifiers have come forward during the past ten years. Principal among these are the transistor, magnetic, and dielectric amplifiers.

When contrasting these devices, it is impossible to find a more suitable basis of comparison than the type of power supply employed.

The transistor, for example, like the tube, employs a DC power supply. The magnetic amplifier and dielectric amplifier,

on the other hand, employ AC (often high-frequency) power supplies.

Comparisons which use the tube circuit as a standard often tend to discredit from the start all devices requiring power supplies, even before other characteristics are considered.

It is interesting to examine the operating principles and characteristics of tubeless amplifiers. This article surveys the characteristics and is intended to provide the reader with an overall view of the present art. This basic information will permit a more discerning examination of the improvements constantly being made in this class of device.

The TRANSISTOR depends for its operation upon its control of electron flow in a solid material (semiconductor) instead of in a vacuum.

Transistors in widest present use are triodes, although some tetrodes have been developed and a few are available commercially.

In a triode transistor, the emitter electrode functionally resembles the cathode of a tube, the base the grid and the collector the plate. A DC supply places the proper bias on the electrodes. The transistor is a current-operated device.

Depending upon the manner in which the transistor is connected into the circuit, the signal output current may be higher or lower than the signal-input current. However, since the output resistance normally is higher than the input resistance, both voltage and power gain are provided, even when the current gain is unity or less.

Figure 1 shows representative transistor amplifier circuit of the common-emitter type (also called "grounded emitter").

Figure 1 (A) is the conventional resistance-capacitance coupled type. The collector load resistors (R_4 and R_8) correspond to the plate load resistors in a tube amplifier.

Emitter resistors R_3 and R_7 are similar to the cathode resistors in a tube circuit and are by-passed (C_2 and C_4) for the same reason — to prevent degeneration.

SINGLE DC SUPPLY

The single DC supply, B, provides negative voltage for the collectors and negative voltage, through divider network R_1 - R_2 and R_5 - R_6 , for the bases of transistors TR_1 and TR_2 .

Figure 1 (B) shows a transformer-coupled amplifier. Higher gain is obtained when transformers are used between transistor stages, since they provide a close match between the high-impedance collectors and low-impedance bases. This permits maximum power transfer, impossible in the cascaded RC-coupled circuit of Figure 1 (A).

As in vacuum-tube practice, transistors may be direct coupled. (See Figure 1C.) This allows the amplification of direct-current signals, as well as extending the frequency range of AC signal amplification down to a cycle or less per second.

The direct-coupled amplifier provides somewhat less overall gain than the RC-coupled and transformer-coupled circuits.

At this writing, the following characteristics are representative of transistor amplifiers:

Frequency Range. Zero to 600 Mc (including special high-frequency types).

Efficiency. 30 to 40 per cent Class-A, 50 to 70 per cent Class-B.

Power Output. Up to 40 watts. (60 watts and higher have been reported in experimental, laboratory models).

Power Gain. 40 db per single-ended stage.

Size. Subminiature in conventional types. Small in high-power types.

The MAGNETIC amplifier offers the advantages of simplicity, ruggedness, compactness, foolproof circuitry, unlimited life, and components not easily burned out in normal use. The magnetic amplifier requires an AC power supply.

Figure 2 (A) shows a basic magnetic circuit. In this ar-

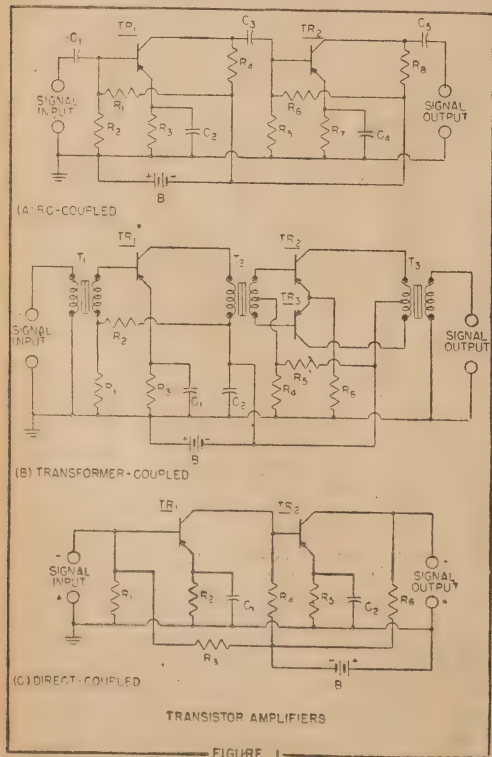


FIGURE 1

agement coils L1, L2, and L3 are wound on a three-legged core made of a special alloy having a rectangular hysteresis loop.

Coils L1 and L3 are connected in series with each other and with the AC power supply and load. The impedance of this combined winding therefore is in series with the power supply and load and determines the load current and voltage drop.

Direct current flowing through the control winding, L2, produces varying degrees of saturation in the core, depending upon the direct current level. This saturation lowers the impedance of the L1-L2 combination and allows more AC to flow through the load. The voltage drop across RL thus is proportional to the applied DC voltage.

When DC output is desired, a semiconductor rectifier may be connected in series with RL, as shown by the dotted-line symbol. Because a small DC input produces a large change in output, amplification takes place.

Frequently, in place of DC, an AC input signal is employed. However, the power supply frequency must be several times higher than that of any AC signal which is to be amplified (usually not less than 10 times the signal frequency).

DC, LOW FREQUENCIES

This requirement has limited most large, practical magnetic amplifiers to the handling of DC and low frequencies. However, audio-frequency magnetic amplifiers have been constructed to operate from 100 Kc power supplies, and special experimental amplifiers with small, thin cores of high-efficiency alloys have been shown at power supply frequencies up to 10 megacycles.

Figure 2 (B) shows how a fourth core leg and winding may be added for feedback. Both positive and negative feedback have been employed in magnetic amplifiers. The feedback polarity depends upon the sense of winding L3.

The regeneration provided by positive feedback increases the sensitivity, while the degeneration provided by negative feedback improves the signal waveform.

The circuit of Figure 2 (B) is shown arranged for DC input and output. However, it may be adapted for AC signal amplification by omitting the output rectifier and feeding back a portion of the AC output to L3 in the proper phase for regeneration or degeneration, as desired.

Like transistors, magnetic amplifiers have low input impedance. They have excellent power-handling ability, having been employed at levels up to many hundred kilowatts. They have replaced tubes in some voltage-regulated DC power supplies.

Their response speed is somewhat slow when compared with that of amplifiers of other types, chiefly because of the magnetization characteristics of the core material and the limitations imposed by the low power-supply frequencies.

The DIELECTRIC amplifier may be thought of as the capacitive counterpart of the magnetic amplifier.

Employing an AC power supply and operating in a similar fashion, the dielectric amplifier utilizes a change in capacitive reactance, in contrast to the magnetic amplifier which uses a change in inductive reactance to obtain control of output current and voltage.

The heart of the dielectric amplifier is a capacitor containing a voltage-sensitive dielectric. The latter is a material, such as barium titanate, the dielectric "constant" of which decreases with applied voltage.

CAPACITIVE CONTROL

When such a capacitor is connected in series with an AC power supply and load, it may be used to control the current flow through the load as its reactance is changed by a biasing control-signal voltage.

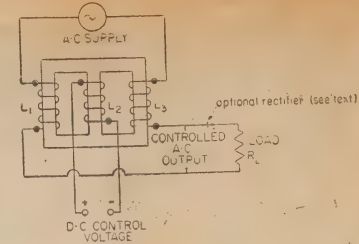
Figure 3 shows one type of dielectric amplifier circuit. Here, the AC power supply is a high-frequency type. (In practical circuits, the frequency is "A" 1 megacycle or higher.)

The non-linear capacitor, C3 (i.e., the capacitor with voltage-sensitive dielectric) is connected in series with a conventional capacitor, C2, across inductor L1. This series-capacitance combination forms a tuned circuit with L1 resonant at a lower supply frequency.

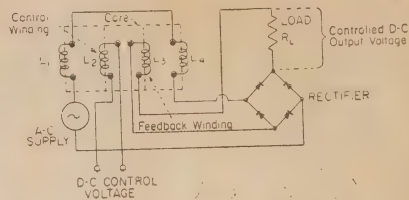
The DC source biases the voltage-sensitive dielectric to the steep portion of its capacitance-vs-voltage curve. The input signal is applied in series with this DC voltage. C1 is a blocking capacitor.

The input signal (waveforms C and D) varies the capacitance of C3, detuning the L1-C2-C3 circuit in sympathy with the input frequency.

If C2 is adjusted to place the response of the tuned circuit along its steep slope, the resulting voltage changes will be large and the amplitude-modulated signal waveform will



(A) BASIC AMPLIFIER



(B) FEEDBACK TYPE

MAGNETIC AMPLIFIERS

FIGURE 2

have high peaks. (See waveform B.) This accounts for the amplification afforded by the circuit.

The waveform shown at B, however, contains a high-frequency carrier component (A), as well as the modulation envelope which is an amplified replica of the input signal. The latter is recovered by passing the modulated signal through diode D, the result being the amplified wave, E.

Dielectric amplifiers have been employed at signal frequencies up to 2 to 3 megacycles. They provide high voltage gain and high power gain per stage. Power gains up to 10,000 per stage have been reported. Small units have been used to obtain audio frequency power outputs of 300 milliwatts.

HIGH INPUT IMPEDANCE

Unlike the magnetic amplifier, the dielectric amplifier has high input impedance. Like the magnetic amplifier, it requires a power supply frequency at least 10 times higher than the highest signal frequency which is to be amplified.

Its principal shortcoming is the pronounced temperature-sensitivity of the non-linear dielectric material it employs.

Additional tubeless amplifiers which are not as well known nor as well developed as the three types described in the foregoing sections include the diode type and galvano-

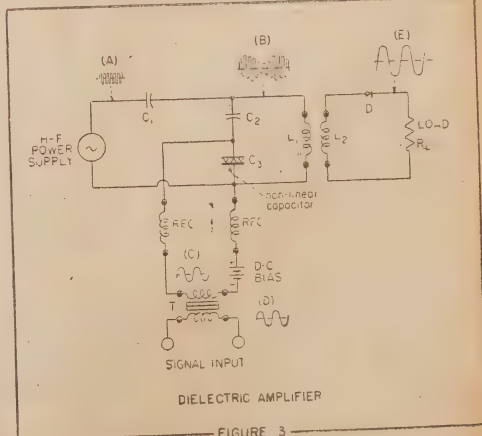
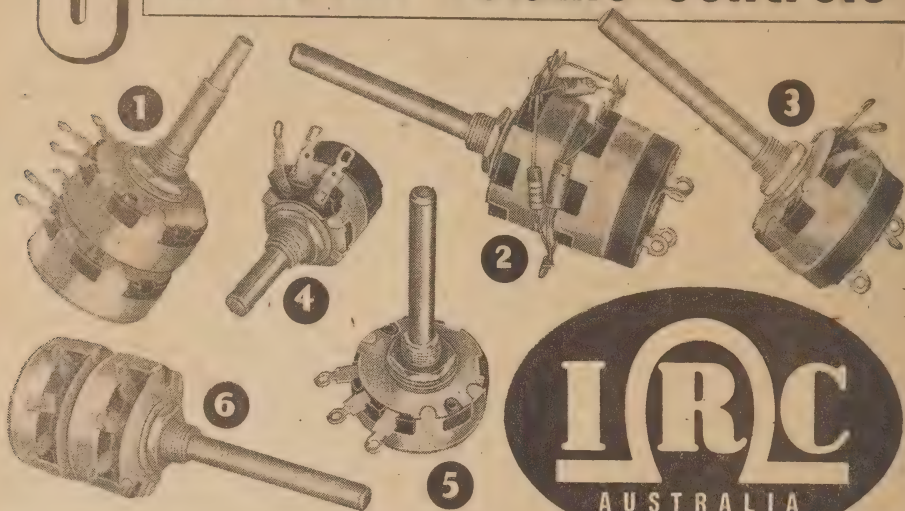


FIGURE 3

6

different volume controls



**Proven performers with . . .
the quietest and smoothest operation**

IRC HAS A TYPE . . . A SIZE . . . FOR EVERY APPLICATION

1 Concentric Dual Controls

Standard IRC Plain or Tapped Volume Controls, assembled as Concentric Pairs. Supplied in combinations of Carbon/Carbon or Carbon/Wire-Wound Types, with the addition of Single Pole or Double Pole Switch on rear unit if required. (The Wire-Wound Control can only be supplied on the rear unit.) Each section individually rotatable over normal rotation range.

RESISTANCE VALUES—Carbon Types: 500 to 10.0 Meg.; Wire-Wound Types: 5 to 10,000.

TAPERS—Carbon Types: Linear A or log. C. Wire Wound: Curve A (linear).

4 IRC Miniature Type Q Volume Control

Control features small size, 15/16in. dia, terminals riveted to element, superior performance, moulded bakelite base.

CONTROL BASE IS MOULDED of high-strength, first-grade bakelite which eliminates mechanical distortion and moisture absorption associated with the use of punching bakelite.

WIDE RANGE of resistance values and tapers, with or without taps.

ELECTRICAL ROTATION—300°.

SHAFT—2 1/2in. and 3 1/2in. dimension "A" standard, insulated 1/2in. dia.

COVER—Earthed.

2 Type LBI Loudness Control

Fit NEW IRC Type LBI Continuously Compensated Variable **LOUDNESS CONTROL** to your radio or amplifier and automatically keep the proper balance of all frequencies within the audio range at ANY listening level. Boosts highs and lows as volume is decreased, maintains depth and brilliance even at whisper level in any radio receiver. The Loudness Control will replace any volume control by transposing three simple connections. Can be fitted without experience. Available in 1 meg. 500,000 ohms, with or without switch.

5 Type W Wire-Wound Controls

RESISTANCE VALUES—Available in all standard values between 5 ohms and 10,000 ohms, 2 watt rating.

WATTAGE IN ROTATION—Mechanical rotation 295°. Electrical rotation 266°.

ALL SHAFTS ARE INSULATED—Maximum operating voltage from any terminal to ground is 900 volts RMS at standard atmospheric conditions.

DIMENSIONS—Diameter, 1 1/2ins. Depth from mounting face, 9/16in. Shafts 1/2in. dia., 1/2in. bushing. Standard shaft length, 2 1/2ins., from front plate to end of spindle.

3 Type CS Metallised Controls

RESISTANCE VALUES—500 ohms to 10 megohms in log. or linear taper.

SHAFT—1/2in. diameter, machined not die cast, standard stock lengths 2 1/2ins. and 3 1/2ins. Shaft insulated.

COVER—Cover grounded to bushing.

SWITCH—S.P.S.T. or D.P.S.T. and D.P. special for reactivation.

TAPS—One standard, also centre tap controls available in linear taper in 500,000 and 1 megohm.

TAPERS—Logarithmic and linear standard.

6 Ganged Type Controls

Available for a multiplicity of applications in amplifying and electronic equipment . . . in 2, 3 and 4 gang . . . in either metallised type CS or wire-wound type W. Operation from common 2 1/2in. shaft.

RESISTANCE VALUES—Metallised Type CS—500 ohms to 10 meg.

Wire-Wound Type W—5 ohms to 10,000 ohms in linear taper only.

NOTE: Combinations of wire-wound and metallised controls are available to meet special requirements.

Sole Australian Agents:

Wm. J. McLellan & Co. Pty. Ltd.

126 SUSSEX STREET, SYDNEY • BX1131
(50 yards from King St.)

When you specify IRC you get a control of proven performance with the quietest and smoothest operation. Write or phone your usual supplier for full details.

agetic type. These are described separately in the following paragraphs.

The DIODE TYPE amplifier utilises the reverse transient ("recovery time") effect found in germanium and silicon junction diodes. Figure 4(A) illustrates this transient characteristic which is explained in the following manner.

If the diode is conducting forward current resulting from the application of a positive voltage from time "to" to "t1," and is switched suddenly to high negative anode voltage by the application of a negative square wave, the reverse current quickly reaches a high peak value (i3) and then recovers somewhat slowly to the value (i2) which is normal for the particular value of applied negative voltage.

The reason for this sudden high conduction is that the carriers (holes or electrons) injected into the semi-conductor by the positive-current flow are still present during the switching and they enhance the current flow.

HIGH INITIAL CURRENT

High current accordingly flows until the negative voltage has had time to sweep these carriers away. Unless the switching interval is of short duration (1 microsecond or less), the carriers will recombine (holes with electrons, and vice versa, within the semiconductor) and the high-current pulse will not be obtained.

If there has been no recent flow of positive current through the diode, no transient current pulse will occur, normal, low current flowing upon application of the negative switching voltage.

In a diode operating in this manner, the anode acts first as an emitter and then as a collector, simulating the action of a transistor.

The transient current is proportional to the positive current and is many times larger. The transient diode exhibits amplification, since a small positive input signal applied to the diode in series with a negative, square-wave, switching voltage (power-supply) will give a higher output signal.

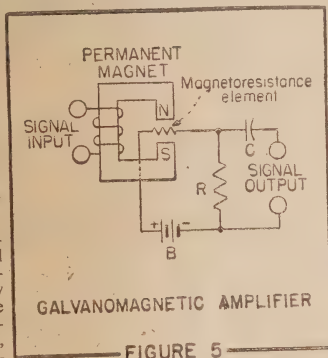


FIGURE 5

Figure 4 (B) shows the circuit of a simple diode amplifier. The power supply delivers 1Mc negative square waves to the amplifier diode (D2) with anode negative.

The positive half-cycles of the signal-input voltage are supplied by D1 which is a high-back-resistance diode having virtually no reverse transient (such as a point-contact diode).

As long as there is no input signal, no voltage appears across load resistor RL, except perhaps a small spike due to the flow of power-supply current through the capacitance of D2, because no carriers are injected into the amplifier diode.

Application of the signal, however, injects carriers into D2, and each succeeding power supply pulse forces a large current momentarily through RL and produces a high voltage drop across this resistor.

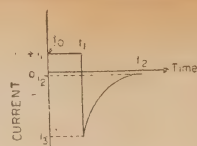
In Figure 4(C), an output transformer has been substituted for the load resistor. By providing a step-down turns ratio in this transformer, a current gain is realised from operation of the amplifier.

Like the magnetic and dielectric amplifiers, the diode amplifier requires an AC power supply. Power gains up to 10 per stage have been reported for diode amplifiers.

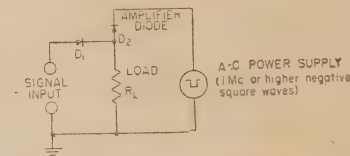
THE GALVANOMAGNETIC TYPE amplifier exploits the phenomenon of magnetoresistance, the ability of certain metallic combinations to change their resistance in response to a varying magnetic field.

Figure 5 shows the circuit of a simple amplifier employing this principle.

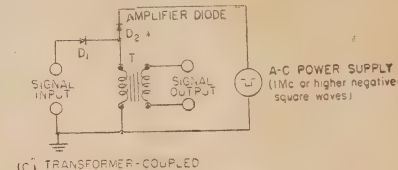
A magnetoresistive element made of a material such as idium antimonide, is supported between the pole pieces of a permanent magnet around which is wound a field coil, L, carrying an alternating input signal current.



(A) DIODE REVERSE TRANSIENT CHARACTERISTIC



(B) RESISTANCE-COUPLED AMPLIFIER



DIODE AMPLIFIER

FIGURE 4

CHANGING MAGNETIC FLUX

The signal causes fluctuations in the magnetic flux which, in turn, cause corresponding fluctuations in the resistance of the magnetoresistive element. A fluctuating current accordingly flows from battery B and through resistor R.

The resulting fluctuating voltage drop is coupled to the output terminals through capacitor C.

Since only a small input signal is required to vary a high current through R, considerable amplification is afforded by this circuit. Thirty to 40 db gain has been reported at room temperature and 60 db at the temperature of liquid nitrogen.

Recorded Voice Stops Power Cuts

"ICE forming on Lecht" . . . "Ice forming on Lecht." . . . This chant from a gramophone record can avert awkward power cuts in North Scotland during spells of cold weather. The automatic warning system has been developed for the North of Scotland Hydro-Electric Board by Pye Telecommunications Ltd.

The board has to maintain long stretches of power line over difficult terrain which often becomes inaccessible in the winter months: the 132 kVA transmission line to Aberdeen which crosses the Lecht Pass is an example. This line frequently has icing trouble, and if ice weighs down the cable unchecked, actual fracture of the line can occur.

Now, a strain gauge (set at 2,600 lb., to cover the tension normally experienced by the pressure of wind on the cables) has been inserted between the insulators on the power cables and the top of the tower which stands at the head of the Pass. When this tension is exceeded through the weight of ice forming on the lines, a closed circuit condition is presented to a relay, housed in the refuge hut below the tower. This starts a turntable and the warning message on the record is played into a Pye "Reporter" device which transmits it back to a control room in Aberdeen.

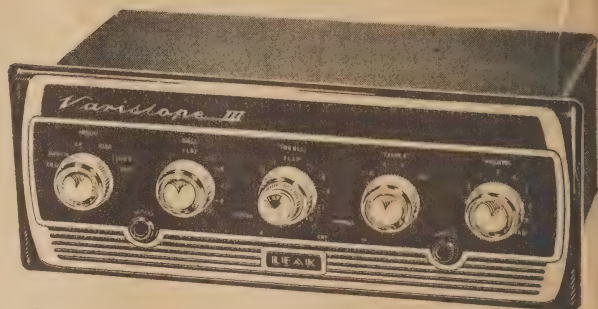
The control engineer then isolates the 132 kVA line and imposes the output of a local generator on to the line to overload it. The heat so produced melts the ice. When the warnings cease—they are repeated every 15 minutes as long as the strain gauge registers a tension above 2,600 lb.—the overload can be removed and normal operating conditions restored.

Regular Shipments now arriving of

The New LEAK "VARISLOPE III", and in keeping with the LEAK Tradition

APPEARANCE

The Varislope III is styled by the world-famous designers, Richard Lonsdale-Hands Associates. The front panel is moulded in transparent Diakon, with all engraving on the rear face, which is finished in brown, white and gold, and the handsome appearance is enhanced by a three dimensional effect. The case-work is finished in beige-gold.



SPECIFICATION VARISLOPE III:

Pickup Selector: A 2-way switch on the front panel allows the choice of any two pickups available in the world.

Input Selector: A six position switch allows the choice of inputs from:—Pickup 1" or "Pickup 2" sensitivity, 9.5mV. There are four playback characteristics, covering all records ever made:—(a) RIAA. The world standard for LP records since early 1955. (b) NARTB. For pre-1955 LP's and USA. 78's. (c) LP. Since 1955, world standard for Coarse-groove (78 records). This position also suits U.S.A. Columbia LP's prior to 1955. (d) 78OE (Old European). For pre-1955 78's.

Tuner: Response, flat. Sensitivity, 50mV r.m.s. with pre-set control.

Tape: Response, flat. Sensitivity, 50mV r.m.s., can be raised to 4mV simply by cutting a wire and the position is then suitable for any moving-coil or ribbon microphone.

Bass Control: Continuously variable plus or minus 16db at 30 c/s.

Treble Control: Continuously variable, plus or minus 18 db at 20 kc/s.

Filter and Slope Controls: The "SLOPE" control varies the rate of attenuation above the turnover frequency between 5 db per octave to 35 db per octave. The turnover frequencies are 9 kc/s, 6 kc/s and 4 kc/s. The "TREBLE" control is also fully operative at the same time. The "SLOPE" control is inoperative when the "FILTER" is at "OFF."

Rumble Filter: Turnover frequency 70c/s. The filter can be switched into circuit when a cheap record-player or changer is used, thus attenuating the low frequencies and reducing any objectionable motor rumble which would otherwise be reproduced through the loudspeaker system.

Jack Socket marked "Replay" on Front Panel:

This input jack accepts signals from a tape replay amplifier embodying playback equalisation.

Jack Socket marked "Record" on Front Panel:

This jack is connected across the output of the pre-amplifier and permits the user to record on to tape from radio or records. Separate continuously variable pre-set controls are situated on the back panel for tuner, PU 1 and PU 11.

Total Harmonic Distortion: Less than 0.01% for 125mV output (which will load any Leak power amplifier). Less than 0.1% for 1.25V output (ten times the requirement for feeding a Leak power amplifier).

Hum and Noise: When plugged into a Leak power amplifier approximately 66db below full power output on radio and tape positions, and approximately 60db below on other inputs.

Dimensions: Front panel, 11½" x 4 7/16" (29.2 x 11.2 cms). Chassis, 10½" x 3½" x 5" deep (26.6 x 9.5 x 12.7 cms).

Installation, Operation and Maintenance:

Each amplifier is accompanied by detailed instructions and circuit drawings. Installation, and operation are simple.

Supplies available from your progressive Radio Retailer

AUSTRALIAN NATIONAL DISTRIBUTORS: **Simon Gray Pty Ltd.**

New TL/12 PLUS, TL/25 PLUS and TL/50

of High Quality and Fine Workmanship

Due to many years of experience and extreme attention to design details during development work on the pre-production models a higher output per man-hour has been achieved. Labour costs thus saved not only offset the increased costs of high-grade materials but make it possible for Messrs. Leak to reduce prices of these world-famous amplifiers.

APPEARANCE

The TL/12 PLUS, TL/25 PLUS and TL/50 are finished in beige-gold stoved paint; and all visible accessory fittings are in black. The general finishes are similar to the TL/12 and TL/10, which have operated for years in high-humidity, high-temperature locations such as Malaya and Hong Kong.

In electrical performance, reliability, appearance and craftsmanship they are in advance of the earlier TL/12 and similarly acceptable to the professional communications engineer.

SPECIFICATION

TL/12 PLUS

TL/25 PLUS

Power Output	14 watts r.m.s. maximum	32 watts r.m.s. maximum.
Total Harmonic Distortion	0.1% at 12 watts output (+ minus 1db) at 1,000 c/s.	0.1% for 25 watts output (+ minus 1db) at 1,000 c/s.
Hum and Noise	85 db, + minus 3db, below 12 watts with a source impedance of 25,000 ohms.	86db, + minus 3db, below 25 watts with a source impedance of 25,000 ohms.
Sensitivity	An input of 125 mV at 1,000 c/s gives 12 watts output	An input of 125 mV at 1,000 c/s gives 25 watts output.
Frequency Response	+ minus 0.5db, 20 c/s to 20 kc/s.	+ minus 0.5db, 20 c/s to 20 kc/s.
Damping Factor	25, measured at 1,000 c/s.	25, measured at 1,000 c/s.
Stability Margins	Gain, 10db + minus 3db. Phase, 20 deg + minus 10 deg.	Gain, 10db + minus 3db. Phase, 20 deg. + minus 10 deg.
Loudspeaker Impedances	Loudspeakers of any impedance between 2 ohms and 20 ohms may be used. An adjustable plug on top of the output transformer selects three tapings, nominally 16 ohms, 8 ohms and 4 ohms.	Loudspeakers of any impedance between 3 ohms and 20 ohms may be used. An adjustable plug on top of the output transformer selects three tapings, nominally 16 ohms, 8 ohms and 4 ohms.
Spare Supplies for Tuner	Heater: 6.3V, 2.1A A.C. max. H.T.: 350V 40mA D.C. max., highly smoothed (0.2V r.m.s. ripple).	No spare supplies available for tuner.
Dimensions	10" x 7 7/8" x 5 15/16" high. (25.4 x 20 x 15.2 cms.)	10" x 7 7/8" x 6 11/16" high (25.4 x 20 x 17 cms.)

TL/50 : Full Details upon request

Circuitry: This is almost identical with the original TL/12 and TL/25, using a 3-stage triple loop feedback circuit, the main loop applying 26 db of negative voltage. Feedback over the complete amplifier from input to output terminals. A low-noise high-gain pentode feeds into a second-stage, double-triode phase-splitter, which in turn feeds two push-pull output valves (tubes) arranged in the distributed-load condition. The innovation of grain orientated steel allows the use of a better output transformer than on the original TL/12 and TL/25.

The Varislope III pre-amplifier, the TL/12 PLUS and the TL/25 PLUS amplifiers, when used with the best available complementary equipment, give to the music-lover a quality of reproduction unsurpassed by ANY equipment at ANY price. Even when the complementary equipment falls below that of the best obtainable, the use of these amplifiers will enable one to obtain very marked improvements in reproduction

N.B. Clients interested in the TL/10 (which is now discontinued) please note: The new TL/12 PLUS is now available with "Point One" Pre-amplifier previously supplied with the TL/10, at very little extra cost as compared to the earlier TL/10 Point-One combination

★

28 Elizabeth Street, Melbourne C1.

★

Telephones : MF8166, 8211

OFF THE RECORD — NEWS & REVIEWS

Interest in the proposed single groove stereo disc continues to grow in both England and America, and speculation as to its form and future can be seen in almost every journal interested in recording. It is difficult, therefore, to avoid making some further comments to add to those I have already put forward in recent months.

IN this respect the article by Norman Crowhurst which appears elsewhere in this issue is particularly interesting, not only because of the general information he gives about the two systems projected, but because of the degree to which he confirms what has already been written in these columns.

It is extremely unlikely that the subject would have gone so far with the actual or implied blessing of the recording companies unless it was their intention to make stereo records.

I feel sure that categorical denials would have been issued long ago if there had been no truth in the story. Such a potentially damaging influence on record sales would demand a counterblast.

NO NEWS STORIES!

The fact is that never from the first time stories of Decca's stereo experiments leaked out, or were allowed to leak out about two years ago, did this company ever refute them.

It just refused to say anything quotable to anybody.

I had quite long talks with several Decca executives when I was in England in 1956. Although they listened politely and even sympathetically to all I had to say about stereo discs, and to any suggestions I had to make, not all my wiles could extract more than superficial information, even under the greatest pledges of secrecy.

They had made such discs, they were very good, they could be issued right away if necessary, and some day they might be.

But unfortunately the cutting heads were under repair, the lab. wasn't set up to play back such records, and so on and so on. No one can say "no" quite as charmingly as a politely determined Englishman.

Nor was EMI more enlightening. There wasn't any great problem about stereo discs—hadn't Blumlein made them as far back as 1932? If ever such discs were made, EMI would certainly turn them out. The only lead I got from St. John's Wood came from an unnameable recording executive, who thought that, despite the demonstrations then being given with stereo tapes, they weren't the real answer for large-scale consumption.

The implication, if I cared to make it, was that the stereo disc was.

THE NEXT STEP

In an article I sent back from England I expressed the belief, strong in me at the time, that the stereo disc was on the way—that it was the next big step the industry had up its sleeve.

Not the least significant fact in inspiring that belief was Sugden's demonstra-

tions which I heard both in the factory at Bradford and in London.

Not only had he made such records, but he was showing them off. And he was arousing such interest that I felt he would force the hands of the big companies sooner or later.

I think it reasonable to imagine that Sugden's efforts, although hardly likely to match those of EMI and Decca, did in fact play quite a part in tipping the scales.

Even in America, Sugden's discs created greatest interest, and were widely and favourably reported in the entire technical press. But in 1956 I was quite bewildered to find that the big U.S.A. companies were apparently quite uninterested in stereo discs. Tape was their touchstone and the source of their stereo hopes.

The position looks very different today. Not only are stereo discs very much on the immediate agenda, but talks are being undertaken to decide upon a mechanical standard which will be adopted without doubt by the entire industry.

For it is safe to say that, if England and America decide upon one method, the rest of the world will use it too.

No more conflicting standards to make life difficult!

I am sure that others will follow Sugden and make stereo discs soon, even if the big ones do not. But, of course, they must, if they are not to leave the way wide open for newcomers to break into a field already highly competitive.

A further straw in the wind is the appearance in an English hi-fi magazine of an article on stereo discs written by none other than Dutton of EMI International.

by John
Moyle

in which he discusses the two main methods, with full reference to the pioneer work of Blumlein, whose name is almost revered by the recording industry in Britain.

This can be interpreted, I think, as serving notice in a quiet way that EMI is well aware of what is going on, although it is not prepared to refer to its plans other than indirectly.

Although Crowhurst's article covers a good deal of the technical background behind the two systems and their respec-

tive merits and disadvantages, there might well be many aspects which are not yet clear in influencing a decision to use one rather than another.

If I could hazard a guess, I would select the vertical/lateral as being the most likely to win out.

As I see it, stereo must be saleable on a large scale—the largest possible—and this means that it should have the fewest points of sales resistance.

Because it needs extra equipment and special listening conditions, it will have enough of these in any case.

It would appear that a stereo pick-up which will play standard lateral discs can be made more easily with the vertical/lateral system, than with any other.

It would be a great advantage to have a single head for all records, rather than to replace with a stereo head each time a stereo disc was required.

NOT COSTLY

Under these conditions, a couple of 3 or 4 watt amplifiers and a pair of good but inexpensive speakers would be the only major requirements when selling a stereo system to the average man.

The hi-fi addict, who will normally spend more money on his pet hobby, won't be above duplicating his amplifier and speaker system, particularly as the second channel probably won't need to be as elaborate as the first.

I predict that the whole basis of volume, frequency range and dynamic range will shift with the introduction of stereo, and this will modify many of our ideas about acceptable reproduced sound. It is by no means certain that the things we consider essential in single channel listening will be as important, at least in the same proportion, for stereo.

One can easily visualise a position where all discs would be made as stereo, playable either on a single channel or a dual channel. Cheap players would use the former, and better-quality, the latter.

CAN BE BIG

Stereo listening will require a sales campaign to put it over, but I don't think this should be any harder essentially than the task which faced the makers of hi-fi equipment in the first place.

Who would have believed a few years ago that hi-fi would sweep the world as it has?

If stereo can be put forward as a painless alternative, it will succeed without a doubt.

It will probably sound the death knell of tape in its field, just as the L.P. killed tape as a hi-fi medium except for specialists. The trouble with the conversion to tape is that it never was painless. It meant buying new and costly apparatus of an unfamiliar pattern, and abandon-

the equipment already purchased to the good money.

As I have suggested on other occasions, we have just about reached the ultimate in monaural sound quality. Already there are signs that we are repeating ourselves in the finer points of recording techniques, always with refinements but without major steps.

There are many records made six or seven years ago which can hold their own with the best we have today.

Stereo looks to offer the only really new angle in sight.

I don't think we'll see stereo discs soon. Most people think it might be 12 months. Nor do I imagine it will outdate present discs in the same way as the L.P. record sent 78s into the scrap heap. Rather do I think it will come as an elaboration of what we have now, and you can please yourself whether you go with it or leave it alone.

In any case, it's an intriguing prospect for the future.

★ ★ ★

BERLIOZ — Symphonie Fantastique. Played by the Berlin Symphony Orchestra conducted by Charles Munch. RCA L16011. This is a straight performance. The playing is responsive, disciplined and good.

The obvious comparison is with Markevitch on DGG, and it is a comparison with a considerable contrast.

There are far more contours in the playing of the Berlin orchestra, a much greater subtlety of phrasing, a pliancy if I can put it that way.

The Boston lines have far fewer curves and passing comments. Personally I regretted this lack of second order flexibility, although I readily concede that it can be overdone.

Most people will, I think, consider that Markevitch extracts more from the score than does Munch, but here I am repeating myself about the nature of American orchestras.

Most of them exhibit power and precision as elementary and cardinal virtues, and many of them don't go very much further.

As I have said, it is largely a matter of approach and individual reaction.

This tautness stands in good stead in the closing sections, parts of which are the best on the disc.

Here the instrumental work is again noteworthy, despite an impression that it was individual rather than comprehensive.

The sound is typical of what we are learning to expect of RCA—one soon begins to pick it from EMI, Decca or Mercury.

Frequency range is not really wide in the hi-fi sense, emphasis being placed on impact and presence. In this it is impressive.

I would class it as one of the three best versions.

The surface is a little noisier than normal.

★ ★ ★

DVORAK — Symphony No. 5 in E minor (New Harp). Played by the Vienna Philharmonic Orchestra conducted by Rafael Kubelik. Decca LXTA5291.

Without doubt this is equal to the superior to any other recording available at present, its chief contemporary being D.G.G.'s version with the Berlin R.I.A.S. Symphony Orchestra under Fricsay.

The playing is at all times of high class, sensitive, beautifully controlled, responsive.

And yet I don't know of any recording so far which completely satisfies me.

There is a good deal of sound continuity which most of this symphony requires, and it's hard to achieve in recordings, unless enough reverberation is allowed to come through which might discount other wanted effects.

The famous second movement is a good example of what I mean. The strong melodic figure which runs throughout it must lie against a continuous background of sound which, for all its changes in quality, in pitch, in intensity and in colour must never be allowed to die, or to falter, or to intrude.

I have heard this effect exquisitely done on one or two occasions in the concert hall, but somehow on records it is never fully realised.

I realise that my criticisms, if you share them, are not levelled particularly at this disc.

The D.G.G. is perhaps fractionally better in this respect, but although Kubelik is not above running away on occasions, he is less apt to feature exaggerations than is Fricsay.

The only blue note is an unfortunate combination of sounds which accompany the cor anglais during its second movement solo.

I haven't yet worked out what it is, but it seems to be a strange combination of harmonics of the instruments concerned. The cor anglais is obviously played up a bit for the occasion which accentuates the effect.

A NEW DEMONSTRATION DISC WITH A DIFFERENCE

PERCUSSION IN HI-FI—An Adventure in Sound with Orchestra, conducted by David Carroll Mercury MG 20166.

When in Chicago in 1956 I visited the offices of Mercury in that city, and spent a most interesting afternoon with David Carroll, who took me to the Universal Recording Studios, where this record was made.

It had, in fact, been made only a few days before I arrived in Chicago.

Before leaving Carroll and his team of arrangers, he asked me if I would like to hear a special demonstration disc which had just been cut from a new tape of which he was obviously rather proud.

The disc was one side of this Percussion in Hi-Fi, played so loudly and with such dramatic effect that everyone within earshot abandoned any attempt at work or conversation until it was over.

But it was quite obvious that the recording itself was something different among the procession of noisemakers which have exploited the extent of the latest sound techniques.

And although it was made up of almost every kind of percussive and allied

Otherwise I thought the engineering was extremely good, with a good amplitude cut and low surface noise.

Highly recommended.

★ ★

NIGHT RAIN AND SURF.— Specimen Recordings of Unusual Subjects. Cook Record 002.

This is just what the title says: the pounding of the sea on one side, rising to a huge crescendo and dying away to gentle lapping of waves, and the steady sound of rain beating on the ground and dripping from the roof on the other.

It is a disc strictly for the sound collector, and those who see no point in spending half an hour listening to the rain falling need not apply.

I was quite fascinated with the realism of the rain side.

After about five minutes really listening to it, I just couldn't persuade myself that the drought hadn't broken just outside the front door.

If you have ever sheltered in an old shed from a sudden storm and waited for the interminable downpour to ease off, and yet somehow enjoying the keen sound and smell of the new rain, you will qualify for a prospective rain listener.

Rather fascinating, too, to see what experiments with top cut will do to this sense of realism.

Well, Emory, at least I enjoyed it!

★ ★ ★

MORE GEORGE WRIGHT— Twelve Popular Numbers on the 5-Manual Wurliizer. Hi-fi record R-707.

Not quite as mighty as the first record reviewed elsewhere, but there is still plenty of organ to be heard, and playing which will delight you if Wurliizers are your meat. Once more it's a pleasure to hear a man whose idea of a performance extends beyond about four combinations.

instrument in the modern calendar, it was also music, some of it well-known and some of it newly written for the occasion.

All told, there are 30 different instruments used in this recording, including a piano, harp, contrabass and guitars, which provide body and colour for some of the arrangements.

They produce some of the most brilliant imaginative and tuneful noises you have ever heard on disc.

At one spot you will puzzle over a sound which I hate to say is an 18in cymbal struck very hard and dubbed in with the tape run backwards.

So impressed was I with what I had heard that David Carroll promised to send me one of the processed discs when they were ready for sale.

And that's why I have been slaying my friends with it for quite a while, waiting for its local release.

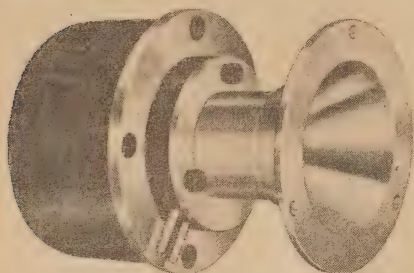
To be honest, the local version isn't as good as the American, for there is some difficulty with instruments, such as the xylophone, which seem to have acquired difficulties with transients.

But it's still good for all that.

Page One Hundred and Three

Goodmans

3 WAY FULL RANGE LOUDSPEAKER System



TREBAX HIGH FREQUENCY PRESSURE UNIT

Trebax is a new high efficiency pressure driven reproducer covering the treble register in multi-channel High Fidelity systems. The frequency coverage is achieved with complete freedom from irregularities in response. The efficiency of TREBAX is such that it may be used with the most efficient bass and mid-range units.

SPECIFICATION

Frequency Range	2,500 c.p.s. to 16,000 c.p.s.
Impedance	15 ohms at 10 Kc/s.
System Power Handling	
Capacity	25 watts.
Crossover Frequency	5 Kc/s.

MIDAX MID-RANGE PRESSURE DRIVEN HORN UNIT

This entirely new reproducer is designed for high efficiency low distortion coverage of the middle register in multi-channel high fidelity systems.

It consists of a pressure driver and horn unit designed to cover a total frequency range of 400 c.p.s. to 8 Kc/s.

The efficiency of Midax is such that it can be employed with any direct radiator up to 18 inches in diameter.

SPECIFICATION

Frequency Range	400 c.p.s. to 8 Kc/s.
Impedance	15 ohms at 400 c.p.s.
System Power Handling	
Capacity	25 watts.
Crossover Frequency	750 c.p.s. and 5,000 c.p.s.



AUDIOM 60



AUDIOM 80



AUDIOM 70

AUDIOM BASS LOUDSPEAKER

The AUDIOM series of loudspeakers are robust single cone units and feature the refinements necessary for very low distortion reproduction of the bass register and the high reliability under full load conditions. The cross-over points may be placed at any frequency below 800 c.p.s. depending on the requirements of the other units.

SPECIFICATION

	AUDIOM 60	AUDIOM 70	AUDIOM 80
Flux Density	14,000 GAUSS	17,500 GAUSS	17,500 GAUSS
Bass Resonance	35 c.p.s.	35 c.p.s.	35 c.p.s.
Power Handling Capacity	15 watts	20 watts	25 watts
Impedance at 400 c.p.s.	15 ohms	15 ohms	15 ohms

Demonstrations and Supplies Available from

- NEW SOUTH WALES: United Radio Distributors Pty. Ltd. Audio Engineers Pty. Ltd.
- VICTORIA: Homcrafts Pty. Ltd., J. H. Magrath & Co. Pty. Ltd., Radio Parts Pty. Ltd. Warburton, Franki (Melbourne) Ltd.
- SOUTH AUSTRALIA: Gerard & Goodman Ltd. New ton McLaren Ltd. Radio Electric Wholesalers Ltd.
- QUEENSLAND: Chandlers Pty. Ltd.
- WESTERN AUSTRALIA: Atkins (W.A.) Ltd. Carlyle & Co. Ltd. Leroya Industries Pty. Ltd.

Sole Australian Agent:

BRITISH MERCHANDISING PTY. LTD.

BOX 3456 G.P.O. SYDNEY

HARPO IN HI-FI—Harpo Marx
In 12 popular numbers, with orchestra; arrangements by Freddy Katz and Bill Marx. Mercury MG 20232.

To remember the Marx Brothers is to late one-self today, but those who are privileged to know them in their heyday will always remember Harpo of the curly locks, tall hat and long coat, who chased the girls but never spoke, who made noises from a long stick with a motor-horn attached, and with a harp.

Harpo could never be considered a classical harpist. His boast even today is that he plays only from ear with his own technique, and that's probably true.

Nevertheless, his harp solo provided a high spot in every film.

It was inevitable that, sooner or later, Harpo would be immortalised anew in hi-fi.

This disc not only does that most competently, but comes behind a cover picture of the Marvian maestro ogling through the strings in unforgettable and dangerous glee.

This isn't poor stuff behind a popular name, either. Harpo plays with an eight-piece orchestra almost super-modestly, but always skilfully—as skilfully as the arrangements which give him room to star but never to overpower in some really good work.

In a dozen numbers, "Yesterdays," "Honeysuckle Rose" and "That's All" I liked particularly.

And it is hi-fi, too—not flashy demonstration quality, but carefully balanced, musical near-by stuff cut with good amplitude over a dead quiet surface.

To me, this one was a surprise. You'll buy it for the music, not just for the name.

★ ★ ★
CONVICTS AND CURRENCY
LADS—Early Australian ballads by Ewan MacColl and A. L. Lloyd, with Peggy Seegar and John Cole, guitar and mouth organ. Wattle B2 (7in 33 r.p.m.).

AUSTRALIAN BUSH SONGS—By the Bushwhackers (instrumental and vocal). Wattle B1 (7in 33 r.p.m.).

BANKS OF THE CONDOMINE
—Australian Bush Songs by A. L. Lloyd, with Peggy Seegar and John Cole, guitar and mouth organ. Wattle C4 (10in 33 r.p.m.).

What is the difference between folk music and a good old Australian bush singsong? A good deal, I should think. And yet, if we consider folk music to mean that kind of musical noise which was made when countries were young and primitive and vocal, I suppose we could consider many old-time efforts such as those recorded here as qualifying, despite their often imported origins.

And there is no doubt something of great value in preserving them for historical reasons.

Many are rather dull and banal—little more than doggerel.

But others have a spark which not only gives them life, but an air of authenticity more effective than the inclusion of unephonious place names.

Those which impressed me most were sung by A. L. Lloyd, whose atrociously accurate Australian outback accent is a bit horrifying until one searches the memory and tries to be honest in recollection at the same time.

Those accompanied by Peggy Seegar with banjo and guitar I thought much the best in production.

A couple of numbers from "Banks of the Condomine" showed first-class command of rhythm and arrangement which stole the show, although I doubt whether either instrument was in favour with our forefathers.

Technically, all discs are loud and clear, although not of the highest quality. On the other hand they were not aimed at hi-fi fans, and an odd flaw such as a bit of tape hum, for instance, won't worry the average listener.

I'd like to speak encouragingly of all these records, and prefer to compliment them with honesty rather than faint praise. With their few defects they are an interesting and valuable result of an effort to set down in some degree an echo of our history.

They do it better than anyone else to date.

★ ★ ★
TCHAIKOVSKY — Romeo and Juliet; Francesca da Rimini. Played by the Boston Symphony Orchestra conducted by Charles Munch. RCA L16074.

A lusty performance in which the excitement is pursued with vigour and persistence.

My main impression is that the music is driven too hard and hasn't enough real light and shade.

Cantelli did much better in this regard, and his brand of excitement had more tension, although Munch gives a better value to the final passages.

Despite RCA's emphasis on sound quality, I thought the general effect was rather dull, and without the sharp edge which all those cymbals, etc., require.

Otherwise it is a solid recording, although not remarkable for its dynamic range.

The same general picture is seen in Francesca da Rimini. This is an even noisier work than Romeo and Juliet, and the orchestra certainly has every opportunity to test its endurance in top gear.

Both sides have a spacious atmosphere, tending to the concert hall, and for this type of sound the balance and definition are good.

The surface is a bit rusty, but not more so than Cantelli's, which is its closest competitor.

Of the earlier discs, Scherchen's for Westminster in some respects is the best of all.

★ ★ ★
TCHAIKOVSKY — Violin Concerto in D major, Opus 35. Played by Alfredo Campoli with the London Symphony Orchestra conducted by Ataúlfo Argenta. Decca LXTA 5313.

A very fine record, sharing with that of Oistrakh on DGG first place among all available versions.

It is, however, completely different in almost every respect.

Oistrakh plays with classical, firmly drawn outlines, offering rare dignity and restraint to a work which suffers as much as any other from easy exploitation.

Campoli has restraint too, something almost unexpected from a noted dealer in romanticism.

Without a doubt he is romantic — this is the most appealing thing about his work. But there is no suggestion of mawkishness or over-sentimentality, even in the second movement which lends itself so well to such treatment.

Here he has judged his speeds and his touch most effectively. It is in fact one of the best spots in the concerto.

The recording is unusually forward,

violon tone. In this it contrasts with that of Oistrakh, who gives a more remote, concert performance.

Campoli's bowing is most vivid. There are times when its bounce is rather too prominent, with an almost embarrassing proximity, although his intonation and general technique are so good that one can overlook this in admiration of his accuracy and clean touch.

Technically, he has rarely been heard to such advantage.

He is fortunate, too, in finding the orchestra and conductor in such excellent sympathy. Not for a moment do they lose contact with him or fail to match his warmth and vitality. Most spectacular is the last movement which, despite its headlong pace, is a model of clarity.

If Campoli changes a few note values and makes free with a few rhythms, neither is really out of place. It is the kind of performance which is likely to please and charm all who hear it.

The recording is one of Decca's best, and I can give full marks for its full, round quality, for its balance, and for the exceptionally clean violin tone.

Both frequency and dynamic range are first class.

ALWAYS RELY ON R.D.S.

R Stockists of Television
D Parts, Picture Tubes and
S Turrets.

We can supply all Radio and Electrical Components and are agents for the famous Hotpoint Radio Sets, Distributors of Test Equipment, Valve and Circuit Testers, Multimeters, etc. A Complete Mail Order Service for the Countryman. Call write or phone to—

The Independent Wholesaler
RADIO DESPATCH SERVICE

Radio and Electrical Distributors,
GROUND FLOOR, WEMBLEY HOUSE
841 GEORGE STREET, SYDNEY.
Phone MA1876 Open Saturday Mornings



RONETTE

MICROPHONES & ACCESSORIES

Type S742

£16/9/6



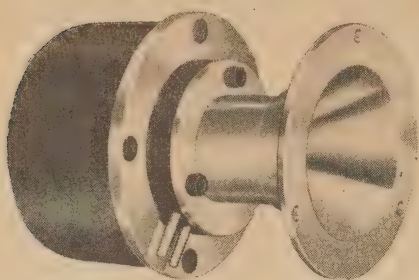
Duo cell, omnidirectional, suitable for cable suspension.

Technical pamphlets mailed on request.

NICHOLSONS LTD.

BARRACK ST., PERTH

Where QUALITY is ESSENTIAL



TREBAX HIGH FREQUENCY PRESSURE UNIT

Trebax is a new high efficiency pressure-driven reproducer covering the treble register in multi-channel High Fidelity systems. The frequency coverage is achieved with complete freedom from irregularities in response. The efficiency of TREBAX is such that it may be used with the most efficient bass and mid-range units.

PRICE £11/19/3.

SPECIFICATION	
Frequency Range	2,500 c.p.s. to 16,000 c.p.s.
Impedance	15 ohms at 10 Kc/s
System Power Handling	
Capacity	25 watts
Crossover Frequency	5 Kc/s

MIDAX MID-RANGE PRESSURE DRIVEN HORN UNIT

"This is the best middle register speaker I have ever heard"

Statement by P. WILSON, M.A.
Gramophone February, '57.



PRICE: £26/5/-

SPECIFICATION	
Frequency Range	400 c.p.s. to 8 Kc/s.
Impedance	15 ohms at 400 c.p.s.
System Power Handling	
Capacity	25 watts
Crossover Frequency	750 c.p.s. and 5,000 c.p.s.

The "MIDAX" and "TREBAX" may be used with the following BASS SPEAKERS:—

"Goodmans" Audiom 60 or Audiom 70

"Wharfedale" W15FS or W12FS

Crossover networks available for two or three way speaker combination.

Call at our showrooms and ask for a demonstration of the Goodmans 3 way and 2 way speaker systems and the Wharfedale 3 way combination.

VISIT OUR
SHOWROOMS

"Sound is our
business"



PHONE BX6731

422-424
KENT STREET,
SYDNEY

CHOPIN—Etudes Opus 10, 11, 25, Trois Nouvelles Etudes. Played by Claudio Arrau Columbia 330CX 1443-1444.

This is likely to be a controversial issue, and it has already proved to be in my own experience, producing the most hotly divided opinions as to its worth.

The Studies are, unique in Chopin's music. They are extremely difficult and impressive technical exercises, but their musical value is unusually significant.

Arrau has seized them with a characteristically firm hand, and many of the results can only be called massive. You won't find much conventional Chopin playing here.

Arrau's power comes more from the thumbs and shoulders than from his fingers.

This doesn't always fit in with Chopin's ideas.

A greater contrast with the playing of Liszt or Smeteterlin could scarcely be imagined.

And yet it is this superabundance of power and strength which some of my friends have found so attractive. It is a part and parcel of Arrau's technique — he does not appear capable of a light or delicate statement which some of these studies demand.

I felt that many moments which should have been handled more in this manner were quite thrown away. Not all of them, but many.

I think this impression might be linked with the recording itself, which isn't as well balanced as I would have liked. There is a difference, too, between the sound of some numbers as against others.

In general, the left hand comes out too prominently. It grows away with a sound which is often tubby, and which quite overpowers the remainder.

Some of the most effective results are in the Nos. 11 and 12 of Opus 25, where the pianist's style is more consistent with the music. There is some tremendous playing here.

In them, Arrau's strong, dynamic effects are much more appropriate than elsewhere.

I wonder, for instance, whether you will like his pedalling in the A flat major with which the side ends?

As I said at the beginning — a controversial issue which should provoke much interest.

★ ★ ★

PROKOFIEFF—Peter and the Wolf; BRITTEN—The Young Person's Guide to the Orchestra Opus 34. Played by the Philadelphia Orchestra conducted by Eugene Ormandy. Coronet KLC 633.

High marks are in order — it would be surprising to hear anything but a first class performance from this orchestra.

The music is tailored to suit it, written specifically to demonstrate the characteristics of orchestral instruments and groups.

Current recordings of both items show evidence of great technical care, and although there are differences to be heard in each, I would not like to undertake a detailed comparison between versions.

This one is in the front rank as a production, and you need have no qualms about how it will sound.

Another point in its favour is the coupling. These are two most appropriate pieces of their kind to occupy opposite sides.

There is no commentary in the Britten, but Cyril Ritchard to my mind is not a good choice for the narrator in Peter and the Wolf.

He lacks sufficient sense of drama, which, in fact, should be extended to a little melodrama to be fully in character.

When he does bestir himself, his timing is frequently astray.

In this role, I don't think RCA's Richard Hale can be bettered. Peter and the Wolf is a fairy story, and a pretty

serious one at that to the juvenile mind. As a story teller, Hale has the competition beaten by a mile.

The engineering is first class, up to demonstration standard.

★ ★ ★

CHOPIN—Polonaise No. 4 in C minor Opus 40 No. 2; Ballade No. 2 in F major Opus 38. Played by Malczuzski - Columbia EP SELO 1561.

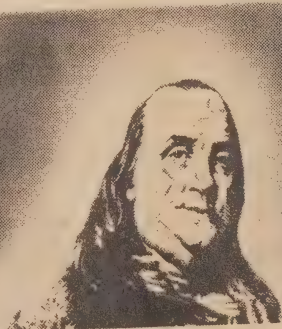
A handy disc of two Chopin favourites.

The Polonaise I liked best, partly because in it the piano sounds so well and partly because there are moments in the Ballade when the pianist appears to get lost.

Admittedly it is a difficult piece to handle, but his performance is more energetic than shapely.

There is a slight pre-echo to be heard; not surprising, for there is a great deal of music on this small disc.

WHAT SECRET POWER DID THIS MAN POSSESS?



Why was this man great? How does anyone — man or woman — achieve greatness? Is it not by mastery of the powers within ourselves?

Know the mysterious world within you! Attune yourself to the wisdom of the ages! Grasp the inner power of your mind! Learn the secrets of a full and peaceful life! Benjamin Franklin, like many other learned and great men and women, was a Rosicrucian. The Rosicrucians (NOT a religious organisation) first came to

America in 1694. To-day, headquarters of the Rosicrucians send over seven million pieces of mail annually to all parts of the world.



THIS BOOK FREE

Write for YOUR FREE COPY of "The Mastery of Life" TO-DAY. No obligation. No salesmen. A non-profit organisation. Address: Scribe,* Q.X.E.

The ROSICRUCIANS

Box 3988, G.P.O. (AMORC) Sydney, Australia

SCRIBE Q.X.E.

The ROSICRUCIANS, Box 3988, G.P.O., Sydney, Australia.

Please send me the free book, "The Mastery of Life," which explains how I may learn to use my faculties and powers of mind.

Name _____

Address _____

City _____

State _____

Another new **ROLA** **LOUDSPEAKER**

Model 12MX, the latest addition to the Rola range, has been designed to give improved reproduction from better class amplifiers, radiograms and TV receivers.

This new, low-cost, triple-cone loudspeaker does not need special baffles—it works excellently in conventional open back cabinets and has a frequency response and power handling capacity which is outstanding in its price class.

The frequency response of Model 12MX extends from 60 to 11,000 c.p.s. and is extremely smooth throughout. The large area of its 12" diaphragm provides excellent bass, and the low frequency performance of Model 12MX is notably free from 'boom'.

All in all, this is an outstanding loudspeaker for the radio, radiogram or TV user who seeks high-grade sound at moderate cost.



BRIEF SPECIFICATIONS

Fundamental Resonance 65 c.p.s. $\pm$ 5 c.p.s.

Frequency Response 60 c.p.s. — 10 k.c.

Power Handling Capacity 7 watts

ROLA COMPANY (AUST.) PTY. LTD

WRIGHT ENCORES
played by George Wright on the
Wurlitzer Hifirecord Album No. 1-702.

ou will have to be a lover of the
Wurlitzer to get full value from
disc, but it isn't just another col-
lection of pieces run off with conven-
tional registration and limited imagina-

his is one of the biggest organs in
the world, and the man who plays it
knows how to make it speak, not rowdily
but with considerable ingenuity, and
etc.

He will show you the difference be-
tween an ordinary theatre organist and
a man who can use every stop and who
enjoys in showing you what they can

do, is powerful, of course. In fact the
Hifirecord company recommended this disc
as a means of showing off the bass re-
sponse of their high-powered speakers,
and after playing selections such as
"Quiet Village" and "American Patrol"
you will see why, that is if your equip-
ment will really touch the bottommost
tones!

The only effect not on the keyboard
is a bird song introduced in "Quiet Vil-
lage," with the tape speed adjusted. I
expect to keep rhythm and tune of the
organ in step with the organ.

Easy to hear, a show piece for your
ears.

★ ★ ★
**FALLA—"Nights In The Gar-
dens of Spain," "Three Corners
Hat Dances," "Interlude and Dance
from "La Vida Breve." Played by
Robert Casadesus and the Philhar-
monic Symphony Orchestra of New
York. Coronet KLC 618.**

**FALLA—"Nights In The Gar-
dens of Spain," Grieg—Piano Con-
certo in A minor Opus 16. Played
by Gutomar Novares and the Pro
Musica Symphony of Vienna, con-
ducted by Hans Swarowsky. Vox
APL 8520.**

Casadesus presents an opulent and
often very beautiful version of music
which can stand more atmosphere than
is given.

I was surprised to find the pianist so
restrained, more noticeable because the
piano isn't as much to the fore as is
usual, although we hear it clearly
enough.

A feeling for style must come from a
number of factors, and not merely from
the notes in the score.

Naturally Spanish music will always
sound Spanish if competently played by
a good orchestra.

MUSICAL VENEER

But I feel, as I do with so many
American orchestras, that there is added
a colouration which is part of that coun-
try's approach to the exploitation of
sound, and which is applied like a
veneer to almost everything recorded
there today.

Time and again I have felt this to be
the main ingredient in disappointment
with many American recordings, even
when this disappointment is a faint one.

It prevents me from applauding this
record as freely as I would like to do.

Its sound is quite big, reverberant,
and frequently brilliant. It has a luxuri-
ant quality which doesn't obscure well-
defined inner instruments, although these
are sometimes rather distant.

Radio, Television & Hobbies, February, 1958

The playing is good, well-disciplined,
powerful, and flexible. Some of the
best records from U.S.A. are by this
combination.

A good deal of the style I thought
missing with Casadesus is caught by
Gutomar Novares on Vox's effort.

This is probably an older recording,
but it stands well in comparison with
today's standard.

Playing sections of these two for com-
parison, I found its flavour more sat-
isfying, although neither could be hailed
as being the last word on the subject.

The Vox piano is more forward; its
tone is a little hard, but otherwise it is
clear and remarkably powerful, particu-
larly in the bass.

A good deal is made of the Grieg,
and that is rather a dangerous thing to
do. This concerto will stand plenty of
vigour, but it bends a little when ex-
panded too large in size.

But this is my only real point of dis-
agreement, and if you don't mind a
rather portentous approach, you'll like
it.

The engineering of both discs is good,
and the surface noise is low. I thoroughly
enjoyed playing them through.

The Vox tone is a trifle sharp—the
EMI curve might help—but Coronet's
is O.K. for the RIAA.

★ ★ ★
**SCHUBERT—Symphony in C
major (Great). Played by the Phil-
harmonic Symphony Orchestra of
New York conducted by Bruno
Walter. Coronet KLC 576.**

Not in the class of the recently re-
viewed records of Bruno Walter.

It has a curious lack of impact. The
first movement is so quiet that I had to
wind up the gain well beyond its usual
position, and even then there was little
presence to it.

The sound, too, was rather ordinary.
The second side sounded much
brighter, but even here I could not find
much to enthuse over.

Maybe some good discs of late have
spoiled me for fair average quality

★ ★ ★
**BRAHMS—Variation on a Theme
by Haydn. SCHUBERT—Sym-
phony No. 8 in B Minor (Unfin-
ished). Played by the Philharmonic
Orchestra, conducted by Herbert
von Karajan. Columbia 330CX
1349.**

The Philharmonia always seems to
play it best for Karajan. Here you
will hear it in grand form; relaxed,
alive, sensitive, firmly controlled in its
dynamics, smooth, powerful and musi-
cal.

In the Brahms it is natural that the
strings and woodwind should show up
best.

Karajan shapes it delightfully, fol-
lowing its mood with well-judged light
and shade.

The Schubert symphony presents the
orchestra with no problem. There are
too many versions of it for me to un-
dertake a comparative assessment, but I
don't remember receiving more pleasure
from any of them than I did from this.

It's a record in which you will re-
ceive a large amount of musical value
for your money, and I could not do
less than recommend it as being a fine
presentation of what's on the label.

And the sound is wonderful.

MUSIC AND SOUND FOR EVERY MOOD

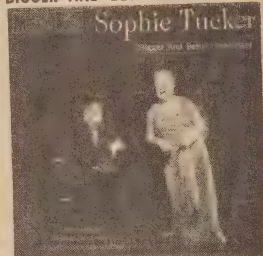
TERREA LEA
FOLK SONGS AND BALLADS



Mary Hamilton: The Turkish Revery: I'm
Sad and I'm Lonely: Gently Johnny my
Jingalo: If'n I was Your True Love: Kate
Kearney: Turtle Dove: Mary and Martha:
The Chivalrous Shark: Red Rosy Bush:
Aunt Rhody: I Wonder as I Wander:
My Boy Willie: Scarlet Ribbons: Billy
Barlowe: All The Pretty Little Horses.

HIFIRECORD R 404

★ ★ ★
**SOPHIE TUCKER
BIGGER AND BETTER THAN EVER**



Take a Look at Yourself: Be As Big As
The World You Live In: Open Your
Heart, Open Your Mind: With Your Life
You Can Do What You Will: I'm Bigger
and Better Than Ever: Love is My One
Bad Habit: The Fountain of Youth: I'm
As Modern As Tomorrow And As Old
As Yesterday: Sophie's Matrimonial Mart.

MERCURY MG 20267

★ ★ ★
THE DIAMONDS



Til My Baby Comes Home: Shoo Ya
Blues: Oh, How I Wish: One And Only:
Honey: Girl of Mine: Honey Bird: For
You Alone: My Dog Likes Your Dog:
Zip, Zip: Cool, Cool Baby: You Are
The Limit.

MERCURY MG 20309

Pressed by the manufacturers of
ASTOR Quality Radios, Radiograms, T.V.

Page One Hundred and Nine

**SWITCH
TO**



PUBLIC ADDRESS SPEAKERS

THE MOST COMPREHENSIVE RANGE OF SPEAKER ASSEMBLIES FOR
EVERY REQUIREMENT.



PA138

Standard reflex horn speaker for medium distance projection of speech and incidental music.



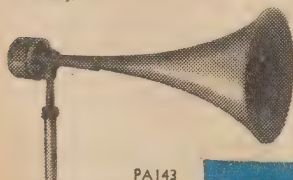
RESLO

DRIVE UNITS: PA108 & PA109

SU10 & SU12

Exclusive features are the self-locating diaphragm and the concentrically interlocked magnet which together produce an undisplaceable mechanical assembly, proof against de-centering.

These flare baffles are for use with 7in and 12in permanent magnet cone speaker units and provide high conversion efficiency.



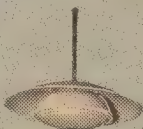
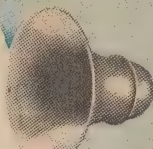
PA143

Short exponential horn speaker for distance projection of speech only.



PA130

Standard exponential horn speaker for public address where distance projection of speech and incidental music is required.



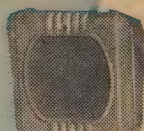
PA118

Pendant type, ceiling suspension, 360° diffusion speaker suitable for distribution of voice and music.



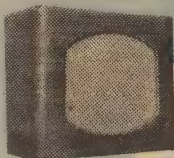
PA177

Flush, ceiling mount 360° diffusion reproducer with 7" cone speaker. Can be colour matched to suit any background.



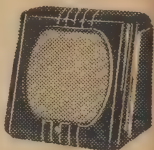
PA150/Z

Attractive moulded ivory cabinet with 7" cone speaker and 600 ohm line transformer. Suitable for wall or desk mounting



PA77/12PS

Polished timber cabinet for wall or table mounting with 12" cone speaker and 600 ohm line transformer.



PA150/W

Moulded walnut speaker, similar to above. These models are also available with 600 ohm stepped faders.



PA73

Ivory timber cabinet with 7in speaker for applications where a bi-directional characteristic is desired.



PA178

Surface mount reproducer similar to PA177, for use where flush fitting is not practicable.

**PLANNED FOR OPTIMUM FAITHFULNESS OF
SOUND REPRODUCTION, IN KEEPING WITH
PHYSICAL AND COST REQUIREMENTS, IN
STYLES AND FINISHES TO SUIT ANY BACK-
GROUND OR CIRCUMSTANCE OF USE.**

AMALGAMATED WIRELESS (AUSTRALASIA) LIMITED

47 YORK STREET, SYDNEY. B0233. 167 QUEEN STREET, MELBOURNE. MU9161.

AVAILABLE IN OTHER STATES FROM

NEWTON McLAREN LTD., ADELAIDE. NOYES BROS. (MELBOURNE) LTD., HOBART AND
LAUNCESTON. CHANDLERS PTY. LTD., BRISBANE. NICHOLSONS LTD., PERTH. ALSO FROM
LEADING WHOLESALERS.

HELIUS — Finlandia. GRIEG — Peer Gynt Suite No. 1. ALFVEN — Swedish Rhapsody. Played by the Philadelphia Orchestra conducted by Eugene Ormandy. Coronet KLC 619

The Philadelphia Orchestra treats Finlandia just as one would expect. From first incredibly full and luscious brass chords, through the resounding brass crashes and "celebrated" hymn tune (which incidentally was the composer's own) to the wild finale, it goes with high-powered way.

It sounds magnificent, but I don't think Helius meant it to smack quite so much as the U.S. Marine band as it does. On the other hand, this is the first Finlandia I can remember for a very long time, and if it isn't completely national in nature, it's a spectacular noise.

The Swan of Tuonela is very much less blatant. The playing and recording is very beautiful. It's hard to avoid the word glamorous, and it seems uncharacteristic to be in any way critical of such lovely work, but there should be an air mystery which eludes the players.

The same fine performance is given to Grieg and the Swedish Rhapsody. Not very many orchestras can compete with this kind of tone quality, or equal its instrumental control.

It makes up for a great deal.

For sheer sound it will play well on any equipment, and on the best it will be superb.

The surface is noiseless.

★ ★ ★

ELGAR — Introduction and Allegro for Strings. VAUGHAN WILLIAMS — Five Variants of Dives and Lazarus. Played by the Halle Orchestra conducted by Sir John Barbirolli. H.M.V. BLP 1049.

Both sides well done. Careful listening will reveal that this is not the Philharmonia, but if there is a touch of edge and perspiration about the higher strings it is matched by vitality and eagerness.

The full heights of climax are not reached as fully as I anticipated, nor is the net impression as smooth as other combinations would have had it.

But I can vouch for the fact that it is all characteristic of the Halle which, on its day, can produce fine results.

The Vaughan Williams comes from his later years, although the mood is from earlier days, but it carries with it the mark of maturity.

It is, in fact, a set of variations on an old English folk tune and carries with it a wide range of invention and colour in typical Vaughan Williams style.

I would have liked better handling of the solo violin in the third episode, and added some extra bass to reinforce the finale.

It is a commendable effort, representing important examples of English music. The recording is rather distant, and a better balance might have resulted from more care with the mikes.

★ ★ ★

IRRESISTIBLE STRAUSS — Gypsy Baron, Delirium, Artist's Life, Emperor Waltz, Pizzicato Polka, Blue Danube Waltz. Played by the Philharmonia Orchestra conducted by Herbert von Karajan. Columbia 330CX 1393.

There have been quite a few Strauss records of late, but this one has a difference.

I don't think I have ever heard this kind of music played more beautifully. Karajan's emphasis is on the symphonic.

He and the orchestra give it as much serious attention as they do any major work.

The result is luscious sound, full dynamics, and all the trimmings that a big orchestra can give.

There is great vitality, too; everybody attacks his work as though really concentrating.

Once again you will be impressed with the power of this fine orchestra — it sounds like a giant whether raging or in repose.

It's hard to pick and choose, but the Emperor and Artist's Life I thought particularly good.

Well named — you could easily find this irresistible if you like Strauss.

And the surface is excellent

★ ★ ★

BEETHOVEN — Sonata in C major Opus 53 (Waldstein); Sonata in A major Opus 101. Played by Hans Richter-Haaser. Philips A 00368 L.

The Waldstein shows more than average quality, in which more power builds up toward the end that I would have expected judging from the opening.

Here its size is quite small.

It is a clearly articulated performance. Richter-Haaser is a thoughtful pianist, and sometimes pays more attention to local effects than to the over-all flow of the music.

He plays with a full, firm tone without achieving much of the emotional intensity which the best Waldsteins should have.

But it is altogether too good to discount merely because it may not be the best.

EVEN BETTER

The Opus 101 I thought even more successful.

In it the clear and rather analytical approach has missed very little.

An extremely good piano recording helps both sides. It is very well positioned, balanced, and, despite a close mixing, extremely clean in playback.

There is no hint of tubbiness in the bass. It comes out with a full, strong tone, and is appropriately taut in the hard hit passages.

The only drawback is that the surface noise is higher than I'd like.

On quiet passages it is clearly audible.

★ ★ ★

OVERTURES — Hebrides, Roy Blas, Poet and Peasant, Prince Igor, Russian and Ludmilla, Ivan the Terrible, Cortège and Dance of the Tumblers. Played by the Philharmonia Orchestra conducted by Nicolai Malko. H.M.V. OCLP 1110.

A good deal of popular music here, and all of it is good. The recording, too, is OK, but without the richness of the best Philharmonias.

The bass isn't as full, and doesn't respond much to boosting. You can just hear the cymbals in Poet and Peasant but the net effect is rather middy.

Malko is content to give honest, straightforward performances, and there is no particular reason why he shouldn't.

The orchestra can be relied upon to do the rest.

NOTICE!

A SOUND INVESTMENT

IN HIGH-FIDELITY SOUND

THE M.B.H. PICK-UP

THE NEW

M.B.H. TYPE "D" PICK-UP HEADS

The M.B.H. type "D" pick-up heads plug into the standard M.B.M. arms without modification but give improved response and greater reliability. The marking on the heads gives an indication of the impedance of the line, transformer, or load resistor into which the various heads are to operate. This impedance must be adhered to. The equalised heads marked "E" have the correct treble roll-off to the characteristic curves BSS No. 1928 (R.I.A.A.) fine and coarse groove records. To special order they can also be supplied to suit other curves. These heads are expected to be of use in studios to save the operation of switching curves, as a single fixed equaliser can be used for the bass section of the curves.

TYPES AVAILABLE

Type	Load Impedance	Output at 15 Allowable cm/sec	Output at 15 Allowable cm/sec	Max Lead Cap
D7	200 ohms	1mV	15mV	—
D6	600 ohms	3mV	45mV	—
D2E	200 ohms	1mV	15mV	—
D6E	600 ohms	3mV	45mV	—
DISK	15,000 ohms	10mV	150mV	100 p.f.
DISK	50,000 ohms	20mV	300mV	505 p.f.

The House of Quality Products

WILLIAM WILLIS

& CO. PTY. LTD.

428 Bourke Street,

Melbourne C1.

Phone MU2426

MANY AFRICAN SIGNALS FORECAST

NEW LONDON SCHEDULE

SWEDEN is celebrating the 10th year of its DX session, which has been conducted throughout that period by Arne Skoog. The session is broadcast as the last part of the English transmission on Monday at 10.30 p.m., midnight, Tuesday.

The present schedules from Nairobi stations are sent to us by a reader as they appear in the Kenya Press. Forces Radio uses 6.112 Kc. operates from 1 p.m. to 6 a.m., African Broadcasting Service on 4,934 in Swahili, Kikamba, Mikulu Arabic, Kalejin Kisii and Luhya, to 5 a.m. These programs are also on Kampala, 5,926, Dar es Salaam, 3,300 and 5,050 and Zanzibar 4,795 Kc.

BRAZZAVILLE transmissions on 11,970 Kc are now being reported on broadcasts to the Americas when the station opens at 9 a.m. The opening announcement in French is followed by a session in Portuguese, while at 11.30 a.m. the signal has been heard with a broadcast in English to North America. Brazzaville transmissions from French Equatorial Africa have been only

THE shortwave relay of the Davao station DXMC, has moved from the old 3 Mc frequency. It now broadcasts on 7,295 Kc and signs off at 1 a.m.

Plans are under way to increase the power of the DXMC 900 Kc transmitter to 5 Kw and it is assumed that DXH2 will also have a large transmitter. The station is affiliated with the Solinas Broadcasting System in Manila.

THE Deutsche Welle transmitter at Cologne are now on an amended schedule which includes the use of the 15,375 Kc frequency. The broadcasts are now carried as follows:

to America,	11.30 a.m.-2.30 p.m.,	on 15,375,	11,797
to Far East,	5.00-8.00 p.m.	on 21,650,	11,775
to Middle East,	12.30-3.30 p.m.	on 21,490,	11,781
to Africa,	4.00-6.00 a.m.	on 17,815,	15,275
to India,	8.00-11.00 a.m.	on 15,375 and	11,775

The inland transmission from the Perth station VLT6 has been moved from 6,130 to 6,140 Kc. This is probably to avoid the interference from Port Moresby, New Guinea station VLT6, which uses also 6,130 Kc. Perth is now operating 8.30 a.m., 10.15 p.m., Saturday, to 2 a.m. Sunday, and Sundays from 7.30 p.m. to 1.30 a.m.

poorly heard at recent times, due to the jamming which is now frequently present on the 5-metre band. The news session on this frequency and on 15.455 Mc is heard at 3.15 p.m. and normally at much more reliable strength than the transmission from Brazzaville are carried by the 50 Kw transmitter.

COLOMBIAN station Radio Sutatenza will soon operate with a power of 50 Kw. and use the frequency of 5.095 Kc, reports Radio Austral. The new outlet planned for the station will be of 10 Kw operating on 6.075 Kc. The transmission at present have been heard regularly when opening shortly before 8.55 p.m. on 5.095 Kc, the station broadcasting mainly religious and cultural transmissions.

LIBERIAN signals from station ELWA broadcast from Monrovia are reported from North America on 21,535 Kc, from as early as 11:30 a.m. to sign off at 12:27 p.m., and this is the only other signal besides 11,980 Kc, which is clearly heard. When the station first opened transmission, it was received in this area on 4,830 Kc, from 4.45 p.m., but this reception has only been reported during the winter months. This station when used for the 43-metre band, is reported to be carrying the expression "Radio North America, and this is also carried on the channels in the 19, 25 and 31 metre bands.

BALANCE BETWEEN

Since the last war extensive use of frequencies below 28 mc/s by amateurs has provided valuable information on various types of propagation in this part of the radio spectrum. In some cases radio amateurs have been the first to observe reflections of signals by means of various scatter effects.

the uninitiated, results obtained on the 144 Mc/s bands by means of both aurora and meteor scatter methods of propagation in the U.S., by amateurs are, to say the least, astounding. Amateurs are earnestly striving to complete a record on that band, and in view of recent findings it is by no means an impossibility. Two methods of propagation together with tropospheric openings, should provide the means of accomplishing the feat. It is not surprising that the recording of a 50 Mc/s WAS was considered unlikely; today 28 W stations have received this award.

U W districts are included in this total. It would appear that a strategically located W9 or W2 zero could make the coveted WAS on 144 Mc/s. With the extensive use of meteor scatter propagation it is now practicable for W2 and W3 stations to connect with 27 States and from other areas connect with 30 States.

The former mode of propagation for extreme aurora and aurora propagation of signals is of interest. The former mode of propagation of extreme aurora reflection may provide the best mode of a contact. Tropospheric openings have potential for extreme DX, remembering the WASUK-WNLZ contact of 2,540 miles (treated gain), and can provide contacts up to minor scatter distances, but such openings do not occur between some stations that have received meteor scatter contacts. The Persels Showers last August, extreme meteor scatter work was carried out by W stations.

A number of contacts were established in the 1,200-mile region and one station was heard at a distance of 1,800 miles. Although a number of stations competing in this work were using the full KW, quite a number of contacts were made over these distances by stations using 100 watts. Antennae varied between 16 and 3 elements.

These contacts were always made on schedule, exchanges are always brief, and signals often audible only a few seconds. Due to the limitations of the period for which signals are audible, it has been necessary to specify what actually should constitute a QSO over meteor scatter operation.

The accepted arrangement is that each participant in a QSO must log two call signs—his own and the other operator's, plus signal reports. The Persels Showers, most of the signals received were in the form of short pings of a few seconds. On a few occasions 9 bursts lasted a few minutes.

ape recorders are used extensively, and slow tape has provided information at times, but is not normally used as a means of recording

a contact. Some contacts took hours to complete before bursts were of sufficient length to exchange the necessary information.

The amateur who obtains a 144 Mc WAS will have performed a feat of which he can be justly proud—the ultimate in operating awards.

He will have to be well versed in all forms of VHF propagation, be extremely active, and his equipment and antenna systems be efficient.

To date both W2KAY and W9KLR have contacted 36 out of the required 48 States for WAS. W2CKY is in second place with a tally of 34 States.

BRIDGING THE TASMAN

DURING the summer and autumn of this year the N.S.W. VHF and TV section in N.S.W. will make a concerted effort to again bridge the Tasman on 144 Mc/s, a feat originally performed in 1951 when Allan Llewellyn, VK2AH, contacted ZL3AR.

It is anticipated that tropospheric openings will occur during the period, and many VHF enthusiasts will be active.

The original QSO was close to the then world record of 1,400 miles for 144 Mc/s working. The current figure stands at 2,540 miles.

In 1957 the 50 Mc band opened earlier than ever before for Transatlantic contacts. Many were made in October between EI, LA, SM and W stations.

Besides this 50 Mc two-way working, many 28 Mc/50 Mc crossband QSOs were recorded between Ws and OH, PA, F and G stations. These openings are not permitted to operate on 50 Mc/s.

It is still hoped to establish a 50 Mc/70 Mc contact as conditions improve in view of so many Europeans now active on 70 Mc/s.

LUs in South America also worked across the Atlantic to CT3. LU3EX and LU4FBN contacted FRAP in French West Africa and seemed to have enjoyed the best of the 50 Mc DX conditions in late 1957. In only five days LU3EX worked the following prefixes—ZPS, KP4, CO2, CE, JA, XE, PY5, OA4, TX, TQ, YF, P, TI2, KHe and Ws—a remarkable DX list for any band.

Asian and African stations were also operating and the Transatlantic Scatter exchanges were known between South and North America, as being repeated.

With remarkable regularity, XC4IP in Cyprus and VG, ZE ZS stations in southern Africa, are in contact, the ZC4 working on 28 Mc/s and the others on 50 Mc/s.

KZ and K17 stations are also appearing on this band and lists of DX contacts by leading stations appear like a DX record made on one of the HF bands.

HIGHER POWER?

CURRENTLY amateurs are considering the possibility of an approach to the authorities by WIA for an input increase to 150 watts.

The idea was originated by the Western Australian Division and All States are requested to forward their reactions to the scheme to the Federal Executive.

Such an increase would have little effect on the signal strength at the other end or on the possibilities of BC1 or TVL. It will, however, allow amateurs to obtain licensed power with the tubes most readily available on the market.

At the moment, the smaller tubes 807s or 6146s cannot be run at the full available input, and to obtain the possible 150 watts a much larger tube must be run uneconomically. Two 807s or 6146s could be used to provide the full 150 watts while the 813 would be operating much more efficiently.

The licensed power in a number of countries is 150 watts, and even the conservative British post office allow their amateurs to use this maximum power.

W.I.A. MEETINGS

THE February meeting of the N.S.W. division of the WIA will, as usual, be held at Science House, Sydney, and on this occasion the VHF section will present a lecture and provide demonstrations of the latest equipment for use in the VHF portion of the spectrum.

Each year at this meeting the section provides an interesting and instructive evening and hopes to convert a few of the HF gang to the VHF's. The date—February 23.

The December general meeting of the N.S.W. Division saw old-timer Joe Reed, VK2JR, lecture on "Sputnik." He explained the satellite's wanderings around the globe. By means of graphs and charts Joe removed some of the vague ideas we had on the Russian moon's orbits.

By courtesy of the Postmaster-General's Department a series of films were shown on varied subjects from the Olympic Games to the Overland Telegraph.

VHF LECTURE

LECTURER at the February meetings of the N.S.W. VHF and TV section will be John Miller, VK2ANF. The location will be as usual the Gore Hill Technical College. John's subject will be the Design and Construction of Mobile Equipment. As a VHF enthusiast, he will emphasize 144 Mc working, but the information given will cover all bands.

In a review of the section's activity during 1957, secretary Jim Cummings, VK2PM, considered the outstanding innovation for the year was the introduction of the monthly nocturnal fox hunts.

The section conducts two fox hunts each month, one in the evenings and one during daylight hours.

The type of hunt is varied to make it more popular. The December daylight event was the first of its kind—a hunt with the fox operating mobile for the whole period of the search. Dick, VK2ZCF was the fox.

Winners of the event were Bob, VK2OA, and John, VK2AF, second, John, VK2ZAV.

The December evening hunt was won by Dave, VK2AWZ; second, John, VK2ANF. At its conclusion, members gathered for a Christmas party.

The section's Christmas Scramble on 144 Mc/s resulted in Dick, VK2ZCF, with 24 points, winning the event. Second place, a tie between John, VK2ZAV, and Ron, VK2ZBG, and a further tie for third with Jim, VK2ZPM and Phil, VK2ER equal.

EFFECT OF ATOM BOMBS

A MATTEURS in the U.S. have been invited to co-operate in a further field, that of observing propagation conditions during atomic bomb tests.

A number of unusual radio propagation effects have been noted during previous blasts and it is thought some of these may be directly due to changes caused by the bomb, especially when signal paths are directly over the blast area. Reports from amateurs are being requested on unusual propagation effects, noise, etc. that might be associated with bomb explosions.

N.S.W. AMATEURS ACTIVE IN EMERGENCY

MATEURS were again active in emergency work in late December when the Griffith Radio Club (later, N.S.W.) was requested by local authorities to supply communication in a serious bushfire centred around Hillston. The destroyed telephone service was replaced by a radio network covering nearly 100 square miles of country before it was brought under control after Christmas.

Amateurs operated for 24 hours continuously on station in emergency. The Griffith Radio Club, VK2PL, set up a base station in Hillston, while mobile portable stations were supplied and manned by Harry, VK2HJ; Owen, VK2AEB; and Bill, VK2AXD.

The portable stations worked back to base, and among themselves, passing messages of importance in reference to water supplies and fire-fighting personnel.

The work performed by the group was of great assistance in the fire-fighting organisation, and gained another credit mark in public service.

The operation was carried out on the normal N.S.W. WICEN frequency of 7050 Kc/s, and amateurs assisted in keeping the channel free by relaying messages when conditions were difficult. The greatest problem experienced was that of commercial interference in the 7 Mc exclusive amateur frequency assignment. In the early morning hours it was practically impossible to handle messages due to overseas broadcasting stations.

The Griffith Radio Club members must be congratulated on their initiative in supplying equip-

ment and performing the duties for which amateurs are renowned.

At the completion of the work at Hillston the group was requested by the police to stand by in view of deteriorating conditions around Roto. Fortunately, the position improved and amateurs were able to resume their normal duties.

ARRL CONTEST

DATES for the telephony and C.W. sections of the ARRL's W/V/E DX contest are as follows: Telephony: Feb. 7-9 and March 7-9, and C.W. Feb. 21-23 and March 21-23. The contest runs between 2,400 G.M.T. on the first date mentioned to 2,400 G.M.T. on the last date. Serial numbers are to be exchanged and consist of the RST or RS/report and power input.

Leading VK's in last year's event were: Lyell Woolnough VK2GW, 331, 425 points, and Frank Hine, VK2OL, 222, 345 points, in the CW section, and Ray Naughton, VK3ATN, 176,418 points on telephony, VK7KM, 170,676, and VK9KX, 178,716, also scored well.

Some of the W's easily pass DXCC totals during the contest. In 1957 event, Larry Le Kashman, W2IOP, worked 130 different countries in the contest, W3ITK 128 and W8FGX 126. XELA made 3,751 contacts at an average of 100 contacts per hour. 182 entrants scored over 100,000 points.

Activity in tests is especially high during the prevailing DX conditions, and even if you cannot operate for the full period, a few enjoyable hours can easily be spent.

Fixed and Variable Attenuators

for

**Broadcasting, Sound Picture, Television
and Audio Engineering**

General Specifications for Ladder Networks

CONSTRUCTION.—The main body of the Attenuator is of one-piece moulded Bakelite with 28 non-tarnish solid silver studs and a non-tarnish silver wiper ring integrally moulded.

NOISE LEVEL.—Does not exceed 5 micro-volts per volt input.

RESISTORS.—Unifilar wound on moulded Bakelite flat bobbins with the highest grade of resistance wire giving low thermal coefficient and excellent frequency characteristics. All resistors are aged and fully tropic proofed. When carbon resistors are used only the best obtainable are employed.

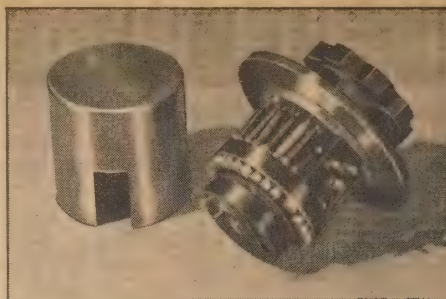
RANGE.—0-39db — variable in steps of 1.5db tapered to infinity on last stud. Anti-clockwise rotation for increase of attenuation.

SIZE.—Depth 1½in. Diam. 1½in.

IMPEDANCE.—50, 200, 600, 10,000, 100K or 470K ohms.

**Suppliers to Manufacturers, Wholesalers and
Broadcast Stations.**

GORDON F. MEE *Specialised Electronic Products*
6 ROWERN COURT, Box Hill, Victoria E11.



Types UF and UP

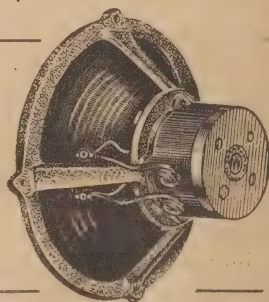
ACCURACY.—All wire wound resistors are adjusted to within 1% on DC.

INSULATION RESISTANCE.—Greater than 1000 Megohms.

MOUNTING.—Panel mounting by two horizontal holes on 1½ inch centres. Shaft diameter ½ inch.

ESCUTCHEON.—Moulded from clear Perspex. Engraved on rear side and filled white with a black background. 2½ inches Diameter.

Better than ever ... THE SUPER 12/FS/AL SPEAKER



**SUPER
12/FS/AL**

Now, Plastic Foam Suspension, (FS), gives this superior Wharfedale production even smoother performance than before. The high flux density gives excellent transient response and sensitivity over

the whole frequency range. Alcomax III Magnet; flux density 17,000 gauss, 1¼" diameter centre pole; total flux 190,000 lines; speech coil 12/15 ohms; cone resonance 30-38 c/s.

Wharfedale

Australian National Distributors to the Trade:

Simon Gray Pty Ltd.

28 ELIZABETH STREET, MELBOURNE C.1.

Telephones: MF 8211, MF 8166.

EW departure introduced at VK2WI in recent months has proved of great value in eliminating unnecessary travel for operators and bringing up-to-date news of divisional activities. A 44 Mc/s link to the transmitting site at

and TV section secretary Jim Cummings, is another who uses 144 Mc/s to supplant news for rebroadcast on 7.146 Mc/s. Links have also been used, and the quality of transmitted signals is excellent. WJ engineers, Dave Duff VK2EO, and Rutter, VK2CB, have worked hard to perfect rebroadcasts. Their reward is the participation of amateurs for the service provided.

the subjects of Films, to open in Sydney in January, is the French film, "Race For the Crown," featuring amateur radio. It covers the story of a ship's crew in distress, where aid was finally obtained by means of amateur radio. The film is shown at the Regent Theatre, Sydney, and is of great interest to amateurs.

ing on the 21 Mc/s band. He can be contacted after 2,100 hours. East, only European QRM to contend with. WAZ was formerly an editor of OKKAAA. This makes contacting all com- munities of the WAZ award will certainly be popular. As zone 23 has been difficult to contact. The AC4s in Tibet were forced off the many amateurs throughout the world have zones for a Zone 23 station to complete the list. As of 1994, all TIAA cards have been received at the bureaus and Ludvik made 1,500 contacts in the first month of operation. According to Jan Sima, OK1JX, editor of "Yves Technical" and sponsor of TIAA, the use of QSL cards has been adopted, but under no circumstances should be direct to Mongolia.

73 may be excused, but as both abbreviations are in plural forms, 73s means "best results" and the same applied to the use of

★ Extreme Frequency Range.
(20 cps. to 20,000 cps. at 7.5 ins. per sec.)
(20 cps. to 30,000 cps. at 15 ins. per sec.)

- ★ Triple Magnetic Shielding (—30db at 50 cps.)
- ★ High Output.
- ★ Micro-aligned Gap (record and play with separate heads with no treble loss).

THE ULTRON 15 series is recommended for:—

- ★ Professional Transcription.
- ★ All Laboratory Uses.
- ★ Full Frequency Reproduction of Pre-Recorded Tapes.

By far the most advanced range of tape heads available, the **ULTRON 15** series is produced in the following types:—

ULTRON 15, ULTRON 15T, ULTRON 15L. Record-Play high impedance, .00017" gap.
ULTRON 15H, ULTRON 15HT, ULTRON 15HL. Record-Play, medium impedance.

ULTRON 15S, ULTRON 15SI, ULTRON 15SL. High-Efficiency Record. .0003" gap.
Note—"T" denotes standard half track; "I" denotes lower half track. All others are full track.

SEND 4/- POSTAL NOTE FOR BOOKLET "MAGNETIC TAPE HEADS," containing full specifications of all LB. Products' tape heads. HI-FI Tape Circuits, etc.

Retail Prices: ALL ULTRON 15 series £9/13/6
Types HE2, HE2T (record-play, commercial quality) . . . £6/3/-
Types EU, EUT, EUL (high efficiency erase) £5/7/-

Available from:—

Victoria:—Homecrafts Ltd., 290 Lonsdale St., Melbourne.
S. Aust.:—A. G. Healing Ltd., 58 Flinders St., Adelaide.
Queensland:—A. E. Harrold Ltd., 123 Charlotte St., Brisbane.

MANUFACTURED SOLELY BY LB PRODUCTS, 95, McDONALD ST.
MORDIALLOC, S.12, VICTORIA. Phone XY1596.

Type No.	Description	Type No.	Description
T5/14 30M 6.3V	150V	T1/20 80M 6.3VCT 6.3V 5V	385V
T5/102 50M 6.3V	225V	T6/18 100M 6.3VCT 6.3V 5V	285V
T3/22 40M 6.3V 5V	240V	T6/26 100M 6.3VCT 6.3V 5V	385V
T1/22 40M 6.3V 5V	285V	T6/20 125M 6.3VCT 6.3V 5V	285V
T1/16 40M 6.3V 5V	385V	T6/28 125M 6.3VCT 6.3V 5V	385V
T1/4 60M 6.3V 5V	285V	T6/22 150M 6.3VCT 6.3V 5V	385V
T1/16 60M 6.3V 5V	385V	T6/30 150M 6.3VCT 6.3V 5V	385V
T1/8 80M 6.3VCT 6.3V 5V	285V	T6/24 200M 6.3VCT 6.3V 5V	285V
		T6/32 200M 6.3VCT 6.3V 5V	385V

AVAILABLE IN UPRIGHT OR FLAT MOUNTING WITH COVER
PLATES FINISHED GREY HAMMERTONE

***Ironcore radio and television power transformers
and chokes are sold by dealers throughout
Australia.***

IRONCORE TRANSFORMERS Pty. Ltd.

HIGSON LANE, MELBOURNE. C.1.

PHONE MF 4771



RADIO

PHONE
LA 3845

136 VICTORIA RD. MARRICKVILLE, SYDNEY, N.S.W.
AND 636 KING STREET, NEWTOWN

EVENINGS and WEEKENDS "KAULA," HILMA ST., COLLAROY PLATEAU — XW5956.
DULWICH HILL, UNDERCLIFFE, EARLWOOD, TRAM AT DOOR, STOP No. 42.

THE OUTSTANDING O-VALVE HI-FI RADIOGRAM CHASSIS

incorporating Mullard 5/10 bass
most amplifier, treble boost dual
wave tuned R.F. stage. Built-in pre-
amplifier for microphone or tape re-
corder including Jensen twin speaker

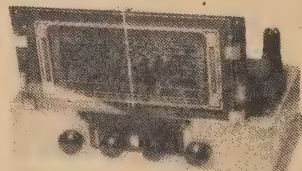
£44/15/-

THE FINEST SET AT ANY
PRICE
CHECK THESE EXTRA
FACILITIES

Built-in Pre-amplifier to suit crystal
microphone tape deck, electronic
guitar, sound on film, TV, etc.
Hear it demonstrated on these units

DEMONSTRATIONS
EVERY SUNDAY 2 to 5 p.m.
OR EVENINGS BY PHONE

APPOINTMENT
AT COLLAROY
PHONE XW5956
CABINETS AND A/L
ACCESSORIES TO SUIT



Dual wave, 6 valve radiogram, chas-
sis includes bass and treble boost
12in Jensen or Magnavox speaker
£23/15/-

8 VALVE RADIOGRAM HI-FI CHASSIS

Dual wave, bass and treble boost
tuned R.F. stage, 12in speaker
£28/17/6

AMPLIFIERS

PUBLIC ADDRESS RANGE 240-AC

1 valve 10 watt £14/17/6
1 valve 25 watt £25/7/6
1 valve 40 watt £32/7/6

BATTERY ONLY OPERATION

1 valve 6v 10w £18/15/-
1 valve 12v 10w £19/15/-
1 valve 12v 25w £24/17/6

BATTERY AND A.C. OPERATION

1 valve 10w 6v £20/15/-
1 valve 12w 12v £21/15/-
1 valve 25w 12v £29/7/6

HI-FI RANGE MULLARD 5/10 £34/15/-

Complete with Jensen twin
speaker, Ferguson O.P.
transformer, 301 and U.I.

MULLARD 5/20 as Above.
£42/15/-

Separate and separate control
with mike pre-amplifier
£12 extra

CHASSIS FOR 17 OR 21in TV

Complete with EHT Box and
sockets £3/12/6
Chassis for 5in £1/17/6

TV

R TV & H KITS

Complete Kits
17in with wired and tested
Steane's Strip and Philips
Turret

£108

21in as above £118

5in. RT & H KITS

5in R. TV and H. Kit modi-
fied for 6in VCR97 £62

STRIPS & COILS

Steane's Pre-aligned
Mark 1 £20
Mark 2 with limiter £23

STEANES KIT OF COILS

For Mark 1 with chassis
sockets and Circuit Diagram.
£6/10/-

Mark 2 £7/7/-

RCS STRIP KIT

For 17in or 21in £7/5/-
For 5in £6/17/6

NEW ALTEC LANSING. THEATRE H.F. SPEAKER UNITS.

£20

R. T. & H. 21" TV CHASSIS

Now on display at Newtown
and Collaroy

SEE IT IN OPERATION

The complete kit of parts
including wired and tested
Steane's or R.C.S. I.F. Strip
and Philips Turret Tuner

£118

Console or TV Gram
Cabinets to suit.
Set can be supplied wired
and tested

NEW ALTEC LANSING. CELLULAR H.F. THEATRE HORNS.

£15

SKYLINE ANTENNAES

A complete range of Antennas
to suit all areas
from

£4/10/-

Special Price for Trade Quantities

For all your TV needs, Bet-
ter Service, Lower Prices and
Practical Advice and Assis-
tance, contact A.C.E. any
hour.

4 SPEED PLAYERS £11/17/6

4 SPEED CHANGERS £16/17/6

5 VALVE RADIOGRAM CHASSIS

DUAL WAVE 12in.
SPEAKER

£18/15/-

5 valve also available as
home constructors' Kit Sets
Complete with circuit.

£14/15/-

7 VALVE DX RECEIVER

3 band, 2 to 6 to 18 megs
160 to 16 metres and broad-
cast. Exceptional selectivity.
sensitivity 2 microvolts. New
Australians, listen to Euro-
pean short wave stations

£29/17/6

ALUMINIUM CUT TO SIZE

16 Gauge 6/- sq. ft
18 Gauge 5/- sq. ft.

COLLARO TAPE DECK

With 5-Valve Amplifier. Speaker.
Crystal, Mike.

£69/15/-

With Built-in Hi-Fi Amplifier

£85

Only the Cabinet required for Hi-Fi
Tape Recorder

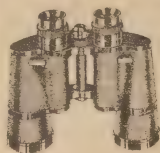
Useful ex-Army and ex-Air Force articles at **SURPLUS STORES** *Large and varied stocks*

Astonishingly low prices

**512 ELIZABETH ST
MELBOURNE C.1**

PLEASE MENTION YOUR STATE IN MAIL ORDER.

BINOCULARS



**FINEST
QUALITY**
All Brand New.
7x50 £18/10/
10x50 £25/15/
12x50 £26/15/
16x50 £28/15/

All coated lenses complete with
pigskin case.
Packing and Postage, 5/-; Interstate, 8/6.

A HIGH LIGHT !!

SIGNALLING LAMPS, 12 VOLT.

Army spotlights, long beam ideal for
shooting. Can be adapted for fitting to
trucks, cars, boats, etc



Twin handles,
rigger switch.
With spare
globe.

PRICE:
39/6

Packing and
postage, 6/-;
Int., 8/6

Safety Belts, As Used in Aircraft.
Highly recommended for car trials.
Quick-release catch. Complete with body
harness. **Price: 19/6 each.** Packing and
postage (all States), 3/6.

SLEEPING BAGS, WITH HOOD.

PRICE: 79/6. Packing and postage, 3/-;
interstate, 6/-

Ideal Bag for Campers

**BRAND NEW LEVER TYPE
GREASE GUNS**



53/6

Ideal for all types of Trucks,
Tractors or Cars, 7500lb pressure
Packing and Postage, 5/-; Interstate 8/6

STUDENTS' DRAWING SETS

Encourage the budding artist
to develop latent talent.

PRICE: 7/3. Packing and postage, 3/6

MICROSCOPES

AN EXCEPTIONAL OFFER.



A splendid gift for any
person -- either young
or grown up. This in-
strument is much more
than a toy; it can pro-
vide many hours of
study.

PRICE: 79/6 EACH.

Packing and postage,
3/6; Int., 4/6.

VERY SPECIAL OFFERS!

Magnifying glasses, 8 mags., 8/6; 10
mags., 12/6. Tapped Transformers, 6,
12, 18, and 24 volts, 3 amps, 45/
Tweezers, 5/6. Watchmakers' Eye-
glasses, 6/6; extra strong, 10 mag., 15/-
Set of five Watchmakers' Screwdrivers,
13/9. American Oxywelding Torches,
£5/10/-, 24 volt, 1,500 watt Gener-
ators, £12/10/-. Brand new 0-1 English
Micrometers, 18/6. Ball Bearing Step-
down Gear Box, 39/6. Steel Mason's
Squares, 24 x 12, 14/6. Pope 5 1/2 in Steel
Planes, adjustable, 52/6. (Please add
postage.)

LEATHER FLYING HELMETS.

Ex-R.A.A.F. Takes Standard Gosport
tube.
Price: 50/-. Packing and postage, 3/6.
Gosport Tubes, 50/-



Watchmakers' Tweezers 6/6 and 5/6
Watchmakers' Eyeglasses 6/6
Extra Strong double lens Eyeglasses 15/-
Screwdrivers, set of five 13/9
Packing and Post. 3/- All States.

**Now Summer Is Drawing Near
SUN GLASSES**

R.A.A.F. type Price: 10/6
De-Luxe type 16/6
Packing and Postage, 2/6.

MAKE YOUR OWN MUSIC BOXES

Swiss Music Units, 30/- each

Many tunes, including Lili Marlene, Harry Lime
Theme, Wedding March, Merry Widow, Happy
Birthday, Anniversary Waltz, Silent Night, Swedish
Rhapsody, Annie Laurie, How Dry We Are, Roll
Out The Barrel, Who's Afraid of the Big Bad
Wolf.
Packing and Postage, 3/-; Interstate, 4/6.

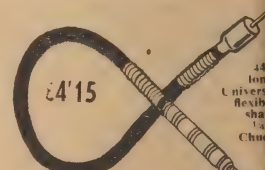
Shooters! Sightseers.

TELESCOPES, GOING CHEAP



20 magnification, pigskin carrying
pocket size, very handy. £5/5/
mag., with tripod. £10/19/6.

Packing and postage, 7/6; interstate,

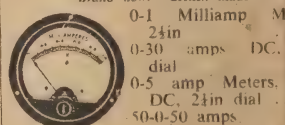


Grinding and Engraving Burrs
Packet of Six, 2/-
Polishing Brushes, 6d each

For hobbyists, die makers, home handy-
men, garagemen, engineers, plastic workers.
Packing and Postage, 5/-; Interstate, 7/6

METERS! SPECIAL OFFER!

Brand new. British made



0-1 Milliamp Meter
24in
0-30 amps DC,
dial
0-5 amp Meters,
DC, 2 1/2 in dial
50-0-50 amps
0-50 amps AC-DC
0-200 amps DC £4
20-0-20 amps DC
0-200 amps AC-DC, 3 1/2 in £4
0-150 milliamps, DC, 2 1/2 in
0-20 volts DC, 2 1/2 in
0-5 milliamps, 2 1/2 in
0-30 volts Weston
0-40 volts AC-DC
0-50 micro amps, 1 7/8 in
0-100 micro amp meters, 1 1/2 in
0-30 V. AC, DC, 2 1/2 in
0-300 Volts, AC-DC, 4 1/2 in dial, £6
Packing and Postage, 3/6; interstate,

ELECTRONS TAKE OVER

(Continued from Page 15)

her film of iron deposited on top. diffraction pattern was taken at room temperature and again at a higher temperature. The change in pattern showed the change in the two metals. In powder diffraction, surface conditions of the films determine whether they will be readily.

Experiments: The covering power and properties of pigments depend upon the crystal structure and chemical composition. For the development of better pigments, control of production, the electron diffraction instrument permits easy examination of material and structure. **Surface Deposits:** The instrument is a useful tool for studying the nature of surface deposits as boiler scale and other mineral residues. Early detection of these phenomena may indicate means of control.

Graphite: The crystal structure and orientation in graphite during and after manufacture can be determined by examination with electron diffraction photographs. These photographs are helpful in the use and processing of graphite.

BANDSPREAD TUNER

(Continued from Page 39)

will be certain of covering the range of VHF converters.

With the original bandspread tuner in the January issue, the aim in designing the coils was to keep the coupling between primaries and secondaries low in order to keep the selectivity high and give image response.

Since the images are now not likely to be a problem it would be permissible to increase the coupling, especially in the case of the two higher frequency bands, in order to improve the signal to noise ratio. For a start, we would suggest interwinding the primary and secondary of the aerial coil. It is not worthwhile adopting this procedure with the two lower frequency bands, since involvement in the signal to noise ratio would hardly have any practical significance.

Moon rocket

AMERICAN scientists should be able to land an unmanned rocket on the moon within five years of launching an inter-continental ballistic missile (I.C.B.M.) according to the president of the American Rocket Society, Navy Commander Robert Traux.

The only thing which stood in the way of "operation moon," he said, was the question of whether the Government was willing to spend the necessary money.

The moon program, he said, would cost about £44,600,000 a year.

He said that if the same resources and energy being expended on the current earth satellite and I.C.B.M. program were directed to the next step in space flight, "we would be able to put an instrument payload on the moon five years earlier we have a successful inter-continental missile."

"What is more," he added, "we would be able to put up a manned satellite in five years."

RADIATION IN OUR EVERYDAY LIFE

(Continued from page 13)

nuclear reactors, and on a small scale in laboratory preparations for research, are a special case; specific absorbing materials are available.

There is some damage produced by radiation in human beings and in living cells in general. The effect that is produced at the smallest dose-rate is probably a slight reduction in the number of white cells in the blood; it is the one, at any rate, that is most easily detected. More spectacular are the effects produced in the chromosomes, or bearers of hereditary qualities, in individual cells—later photographed under the microscope. It is in changes of this kind that genetic effects originate.

There is probably no lower limit of dose below which no genetic effects are produced. On the other hand, we are exposed to natural radiation in any case, and the practical policy is to keep every source of exposure to high-energy radiation to as low a level as possible.

SHORT-WAVE CONVERTER

(Continued from Page 71)

grams aimed at Oceania or Australia, and it is these you are likely to hear at best strength.

Some practice will enable you to learn the best times and bands to use for best signals.

Although most nations abide by their agreement to send out shortwave signals within the prescribed bands, some do not, and, therefore, you are liable to hear stations dotted at odd spots outside their limits.

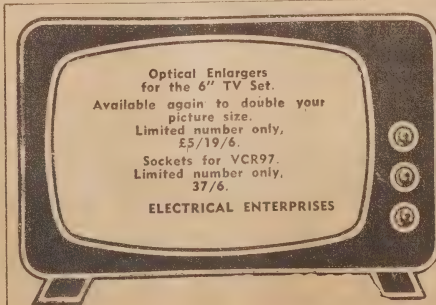
In addition, there are amateur bands at 20 and 40 metres on which strong signals can be heard at most times, both local and distant.

The 20-metre band is the best for tuning in overseas amateurs.

Many of these are not very strong, and special receivers are really needed to make much of them. But, when conditions are good, American stations, in particular, together with others in the Pacific islands, will frequently build up to very good volume, even on a simple converter such as this.

And, as we have already pointed out, the A.B.C. uses shortwaves nearly all the time with programs for outback listeners and for overseas. Some of these use the National program, and others special programs not heard on the broadcast band.

The world is yours—good hunting.



PROBE CAPACITANCE METER

(Continued from page 53)

When switching on for the first time make sure that the maximum resistance is in series with the meter in order to protect it in the event of a wiring fault. In fact, it is a good idea to add several thousand ohms more resistance temporarily, until the circuit is balanced.

Balancing may involve varying the 1,000 ohm resistor in the meter negative terminal, and this depends on a number of factors, including the activity of the oscillator and how much current it is drawing. The ideal arrangement is one where the meter will zero with the zero pot. in the approximate mid-position.

The other major adjustment concerns the full-scale sensitivity which should be 50 pf. This is achieved by varying the resistance in series with the meter, and may also vary depending on a number of factors. The main one is the exact value of the nominal 2 pf. capacitor.

When balance and approximate correct full-scale deflection has been achieved, more serious calibration can be considered. The method of calibration will depend on what is available in the way of standards, and may vary from hand calibration of the meter scale against a sub-standard variable capacitor, to the use of a ready made scale and a check against a number of commercial capacitors to see if it is at least logical.

At the time of writing we have not had an opportunity to prepare a suitable scale, but we hope to do so in time for next month's issue, and also that at least one meter manufacturer will make such a scale available. In the meantime, our readings appear to tally very closely with those suggested by Mr Medina. These are listed in the accompanying panel as a rough guide, and are based on a 50 division scale.

Alternatively, readers who have available a quantity of close tolerance capacitors, such as five of six 10 pf. 5 per cent or better, could easily prepare a suitable scale having a good order of accuracy.

Although a maximum range of 50 pf. will be sufficient in almost all cases, this can be extended by adding external capacitors in series with the probe. A 100 pf. will multiply the range by two (100 pf. full scale) and a 70 pf. by four (200 pf. full scale).

MAIL THIS
COUPON TODAY

ELECTRICAL
ENTERPRISES

246 VICTORIA ST.,
KINGS CROSS

Please send me a book
on TV Kit.

Name

Address

No. 22 & 122 TRANSCEIVERS

The 122 transceiver covers a frequency of 2 to 8 Mcs. and has been approved by the P.M.G. for use on fishing boats, small craft, bush fire brigades, etc.

These sets are supplied complete with valves, 12v. vibrator power supply, dynamic headphones and microphone, 6in x 9in ovaltone speaker, leads, spare kit of valves and two crystals to required frequency. Range to 300 miles. Sets air tested. £40 F.O.R. These units in new condition.

The 122 transceiver as above but less crystals, speaker and spare valves not air tested. £18. F.O.R.

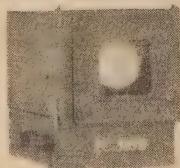
The 22 transceiver as 122, but not converted for crystal control, supplied with valves, meter, power supply, dynamic headphones and microphone £15. F.O.R.

No. 19 TRANSCEIVERS

These units cover a frequency of 2 to 8 Mcs. and contain 15 6.3 volt valves including 1.807, 2-6V6, 6-6K7, 2-6K8 6B8 etc., also 500 micro-ammeter. Units supplied complete with valves, leads, junction box, genemotor power supply and dynamic headphones and microphone (operate from 12v supply). Air tested. £16/15/ F.O.R.

Transceiver only supplied with valves, meter and genemotor £5/15/ F.O.R.
Set of leads and junction box for No. 19 Transceiver 20, plus post and packing 10/. 12 volt Genemotor for 19. £2/15/ F.O.R.

NEW 3in R.F. METERS, 350MA or 1AMP
These meters can easily be converted to 10 or 100 mA meters, new scale supplied with meter. 7/6 Post 2/6.



NEW INDICATOR UNITS

These new indicator units contain 3 valves, controls, etc., and V.C.R. 139A C.R.O. tube and socket. Ideal for that small scope.

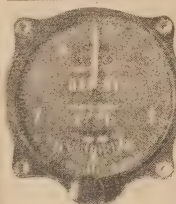
£3/17/6

F.O.R.

Indicator Unit less valves and C.R.O. Tube, 17/6. F.O.R.

BUILDING R. TV & H. 5in. TV SET

ALL MAJOR PARTS IN STOCK INCLUDING R.C.S. I.F. STRIPS AND TUNERS, VALVES, POWER TRANSFORMERS, CHASSIS, ETC.



NEW ALTIMETERS

FIT ONE IN YOUR CAR

17/6

Post Free

NEW DYNAMIC HEADPHONES

These headphones made by Rola are a high quality unit giving excellent tone. Fitted with comfortable ear pads. 27/6. Pots 4/6.

24 Volt Midget Motors Shuset Wound



Fully Laminated Field Wound Armature Sixteen Segment Commutator. ball-bearing. Ideal for Model Trains, Condition New. Hobbyists etc.

Price, each 32/6
Packing and postage, N.S.W., 1/6.
Interstate, 2/6.

VALVE SPECIALS

20/ will purchase any one of the following valve Specials

3	.....	1P5	3	.....	6K8G
5	.....	1C7	5	.....	6SH7
3	.....	1Q5	6	.....	6AC7
10	.....	1KS	4	.....	617G
3	.....	954	4	.....	KTW62/6U7
6	.....	EF50	4	.....	12A6
4	.....	6C8G	2	.....	6X5GT
10	.....	VR65A	5	.....	6K7G

Post and Packing, 4/6 extra.
ALL VALVES ARE NEW.

NEW 6H6 OR 6H6GT VALVES

Individually Cartoned.

20/- per doz.

Post 2/6.

NEW TRANSMITTING VALVES

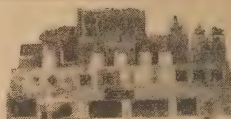
829B	.....	£3/-
100TH	.....	£1/10/-
866	.....	15/-
811	.....	£1

NEW MICRO-AMMETERS

New Paton Micro-Ammeters.
0-500, M.A. 1 1/2in diameter. Flush mounting.

30/-

Post and Packing 2/6.

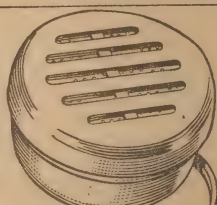


RADAR RECEIVERS

These radar receivers type ZC95 contain 16 valves and a 30Mc I.F. strip suitable for your TV experiment. Units are in new condition.

£3/17/6

Packing 15/- extra.



PILLO-FONE EXTENSION UNITS

IT'S A REAL MINIATURE WITH A ROLA UNIT

Install it anywhere in the bedroom, workshop, garage or any room in the house. It connects across the voice coil of the existing speaker. The "PILLO-FONE" IS THE MOST CONVENIENT LITTLE UNIT YET DEvised.
3 1/2in Diameter by 1 1/4in deep.
POST FREE.

22/6

NEW PUSH-BUTTON SWITCHES 20/

Five pole push-button switches.

New control box fitted with above switch, also 5 bezels with globes and multi contact key switch.

Post: N.S.W. ... 2/

Int. ... 3/

NEW AMERICAN BOX KITES

These kites are constructed of Silk with M frame: SIZE 15in square x 3ft long. Originally used for Aerials for Lifeboat Transmitters. Post 2/.

P.M.G. TYPE RELAY-COUNTER

0-9.999
1,300 ohm coil ... 15

METROPOLITAN RADIO SUPPLIES

479 PARRAMATTA ROAD, LEICHHARDT, N.S.W. — PHONE LM36
640 KING STREET, ST. PETERS, N.S.W. — PHONE LA6087

NEW VALVES AT REDUCED PRICES

105G	1/-	8H6G1	3/-	6SH/G1	3/6	42	12/6
1P5G	7/-	8J7G	7/6	6A3	15/-	193	3/6
1C7G	5/-	9K7G	6/-	7C7	3/6	254	4/6
1K5G	2/6	6K7GT	7/9	7A6	3/6	255	10/-
1L5G	9/6	6U7G	6/6	78	7/6	12A6	10/-
6A6T	3/6	6N6GT	12/6	71A	7/6	EF50	3/6
6B6G	9/6	6N5GT	10/-	EL32	10/6	110TH	£2/9/-
6CRG	7/6	6K8GT	10/6	RTW62/6U7	6/6	811	£1/7/-
6SG7	8/6	616	15/-	VK65A	2/6	866/866A	15/-
6FG6	9/6	6FRG	10/6	CV6	3/6	828	£1/9/-
6E5	8/6					12SH7	8/-
6H6	3/-					12SL7	10/-

PLEASE ADD POSTAGE ON ALL VALVES

ALL GOODS ADVERTISED ON THIS PAGE ARE NEW

NEW POWER TRANSFORMERS

60mA prim.: 240v with 230v taping.
Sec. 285 x 285 with 6.3v filament
winding. **26/6**

Plus Postage: N.S.W. 3/6; INT. 5/3

MICA CONDENSERS

Standard Mica Condensers, small
current types. .00003 to .005
including most wanted values.
Per 100 20/- Postage 1/6

New Midgel Power Trans.

40mA Prim. 250v Sec. 225 x 225
with 6.3v Fil. Winding. Upright or
Flat Mounting. Size 2in x 2½in

24/6

2/6 Postage, N.S.W.; Interstate, 4/6
30mA, 240v Prim. 150 x 150v Sec.
with 6.3v Fil. Winding.

22/- Postage: N.S.W. 2/6;
Interstate 3/6

Electrolytic Condensers

16 mfd 525v	6/6
16 x 16 mfd 350v	4/4
24 mfd 350v	3/3
20 mfd 200v	2/6
250 mfd 12v	1/6
30 mfd 350v	3/6
300 mfd 12v	1/6
8 mfd 350v	2/6
10 mfd 40v	1/6
8 mfd 525v	4/6

(Plus Postage)

12 inch P.M. Speakers

12in per-mag speaker by well-known
manufacturer, 10T, CT, or 5000
Transformer **£3/5/-**
Postage: N.S.W. 6/6; Interstate 9/6

New High Impedance Headphones

30/-

Post 1/6

NEW 5in. PER-MAG SPEAKERS

5F Heavy Duty **35/-**
Supplied with 5T, or 10T, Trans-
former.

Postage Extra: N.S.W. 2/3; Int. 4/6

NEW VIBRATORS

A.W.A. Oak 6 volt Synchronous
7-pin base **9/6**
A.W.A. 12 V Synchronous octal base
7/6, Post 1/6.

I.F. TRANSFORMERS

Standard I.F. transformers, square
can (1 3/8) 455 Kc permutated. 4/6
(Plus Postage)

SAPPHIRE NEEDLES

Rothermel sapphire needles play 2000
recordings. Made in England.
Each 2/9 or 25/- dozen.

Telephone Generators

New small telephone generators, ideal
for bell ringing, etc.

12/6

Postage Extra.

MERCURY SWITCHES

The switch with 1000 uses **2/6**
Postage 6d.

NEW GRAMO MOTORS

New H.M.V. spring grammo motors. Less
turntable. Adaptable for many uses. 19/6
Postage: N.S.W. 4/6; Interstate, 7/6.

CERAMIC TRIMMER CONDENSERS

Small 7-plate 0-20 PF **3/6**
Small Tubular, 0-20 PF **2/-**

GERMANIUM DIODES

for that Crystal Set
7/6. Post Free.

POTENTIOMETER SPECIAL

Box of 10 new Carbon
Potentiometers.
Containing .5 and .1 switch pots.,
long spindle, .5 and .1 standard and
miniature pots., long spindle and
other mixed sizes, short spindle.

20/-

Post 2/6

CONDENSER SPECIAL

Boxes of 100 new mica paper and
electrolytic condensers in values
ranging from 50pf mica to 5 400v
paper. Values include .0001,
.00025, .00075, .01, .02, .05, .1. Also
500 mfd/12v, 10 mfd/40v, 8 mfd/
525v, 16 mfd/350v, electrolytics.

30/-

per 100.

Post Extra: N.S.W. 2/6; Int. 3/6

POTENTIOMETERS

½ Meg Miniature Switch Pots., d/p Switch
Long Spindle **5/6**
1 Miniature Long Spindle **3/6**
Standard ½ or 1 meg. switch pots., long
spindle d/p switch **5/6**
¼ meg. or 25T ohms, short spindle switch
pots. **2/6**
½ meg. or 100T standard pots., long
spindle **3/6**
½ meg. or 100T short spindle **1/9**
¼ meg. high insulation **5/-**
All plus postage.

NEW SMITH'S 8-DAY CLOCKS

These English Clocks — which are
new in original cartons — are panel
mounting and are ideal for cars, etc.
Luminous dials

2in **£4/15/-**
2½in with sweep second hand **£5/15/-**

NEW MICROSWITCHES

6/6

New Throat Mikes **3/6**

Please address all correspondence to 479 Parramatta Road, Leichhardt, N.S.W.

METROPOLITAN RADIO SUPPLIES

479 PARRAMATTA ROAD, LEICHHARDT, N.S.W. PHONE LM3610

640 KING STREET, ST. PETERS, N.S.W. PHONE LA6087

WALTHAM TRADING CO

229 Elizabeth St., Melbourne

MAIL ORDERS TO BOX
5234, ELIZABETH ST.
POST OFFICE.

TRANSFORMERS

Big Purchase of Brand
New Stocks

240-volt Primary
395-volt—395 Volt
5-volt; 6.3 volt C.T.

PRICE 55/-

Packing and delivery to railhead, 5/.

CHOKES

15H, 200mA, 50/.

Packing and postage (all States), 8/.

VALVES! VALVES!

SPECIAL PRICES FOR
QUANTITIES

10B	8/11	CA92	5/
10S	8/11	7W7	2/6
116	7/6	807	19/6
5A8	12/6	811A	19/6
5AC7	3/11	954	8/6
6A15	9/6	955	4/6
5C8	7/6	705A	15/
6H6	1/6	12SR7	7/11
615	2/11	1635	5/
6K7	3/11	1629	7/6
6K8	9/6	AV11	5/
6N7	9/6	CV 65	4/6
6SH7	3/6	EF 50	3/6
8U7	6/9	VR 65A	2/6
6X5	9/6	VR 78	7/6
6Y6	12/6	VR 100	4/6
7A6	5/	VCR.112	50
7A8	5/	3AP1	60
7C5	5/	3BP1 and shield	£5/10
7C7	5/		

Please add postage

MICROSCOPES



Single Eye Turret Model.
Magnifications X100,
X200, X300.

PRICE 79/6

Packing and postage, 5/;
interstate, 6/6

Electric Engraving
Pencils

It works off your car battery. Engraves steel,
copper, bronze, etc. Mark things you desire to
identify.

PRICE: 29/6 Packing and postage, 2/6.

FOR THE CRYSTAL SET ENTHUSIAST

LOW IMPEDANCE
HEADPHONES
17/6

Packing and Postage: 3/6.

GERMANIUM DIODES
3/6 POST FREE

Carbon Hand Microphones

Type No. 3
PRICE 12/6

Packing and postage (all States), 3/6

ALSO AT SYDNEY:

96 OXFORD ST. (MAIL
ORDERS TO BOX 22,
OXFORD ST. POST OFFICE).
ADELAIDE: 243 RUNDLE
ST. (MAIL ORDERS TO
THAT ADDRESS).

SPOTLIGHTS

R.A.A.F. Signalling Lamps



12 volt, 30
watt. Strongly
constructed
with 5-inch
plated reflector
and peep
sight. Twin
handle grips
and trigger
switch. Com-
plete with one
spare globe.

PRICE 39/6

Additional spare globes, 3/6 each.
Packing and postage, 6/; interstate, 8/6.

GENEMOTORS

Suitable for 12-volt Radio Power Sup-
plies. Rating Input, 18 volt DC — 3.2
amps. output 450 volts—DC—0.60 amps

PRICE 59/6

Packing and postage, 7/; interstate,
10/6.

KNIFE SWITCHES

30 amp., 25/
Packing and postage (all States), 3/9.

WATCHMAKERS' EYEGLASSES

Extra strong: 10 magn., 15/.
Jewellers' Screwdrivers, set of 5, 13/9.
Packing and postage 1/6.

MORSE BUZZER SETS



These sets are complete with headphone,
and are an outstanding bargain at the
VERY LOW PRICE:

ONLY 32/6 EACH

Packing and posting, 11/6.
BATTERIES, 1.5 volt, suitable for
Morse Buzzer sets. Price: 3/6.

RIFLE SIGHTS

High Quality. Standard Army equip-
ment. In perfect order. Complete with
mounting bracket.

PRICE £9/19/6

Packing and postage, 3/6.

TELESCOPES

48 x 50, £26/5/; 30 x 58 £19/10
30 x 40, £10/19/6; 20 £5/5/.

Postage and Packing, 5/; interstate, 6/6.

AMERICAN

Handy-Talkie Transceiver

Type BC.611B

Frequency 5786 Kcs. Complete with
crystals, air tested. The smallest two
way radio-phone.

PRICE £25 EACH

Packing and delivery to railhead, 5/.

No. 19 TRANSCEIVERS

In perfect condition. Complete with
Power Pack. Leads and Junction Box
Air tested.

PRICE £19/10/-

Packing and delivery to railhead, 10/.

MICRO-AMP METERS

0-100—1 1/2 in sq. dial £3/11
0-50—1 1/2 in sq. dial £3/11
0-50—2 1/2 in sq. dial £5/11
0-1mA—2 in Weston £2/11

Packing and postage, 3/6.

DURAL TUBING

We have this in many sizes. The
strong metal alloy tubing can be used
for many purposes, including I
aerials and masts and many other uses.

Diameter	Gauge	Price per foot
1 in	18	2/-
1 1/2 in	20	1/-
2 in	20	1/6
2 1/2 in	22	1/-
3 in	16	9d
3 1/2 in	16	1/-
4 in	16	1/-
4 1/2 in	16	1/6
5 in	16	1/9
5 1/2 in	16	1/9
6 in	16	1/9
6 1/2 in	16	1/9
7 in	16	1/9
7 1/2 in	16	1/9
8 in	16	1/9
8 1/2 in	16	1/9
9 in	16	1/9
9 1/2 in	16	1/9
10 in	16	1/9
10 1/2 in	16	1/9
11 in	16	1/9
11 1/2 in	16	1/9
12 in	16	1/9

(No Mail order for Dural Tubing)

(Continued from Page 5)

This heating value is measured in British thermal units, or b.t.u.'s, per pound of fuel. (One b.t.u. is the amount of heat that will raise the temperature of one pound of water one degree Fahrenheit.)

Aviation gasoline contains about 500 b.t.u.'s to the pound; kerosene JP-4 jet fuel, about 18,000. "High energy" designates fuels in the range 25,000 b.t.u.'s per pound and up.

The ideal fuel — if heating value were that mattered — would be pure hydrogen, which tops the list by a wide margin with 52,000 b.t.u.'s per pound. But to use as a fuel it would have to be kept liquefied, a difficult feat.

Fortunately hydrogen can be locked in liquid or solid form, for use as fuel, combining it with other elements. Nature does it with carbon, in making hydrocarbons of petroleum fuels. But a high-energy fuel, the added element itself must have a high heating value. Carbon's modest 13,000 b.t.u.'s to the pound falls short of requirements.

The logical thing would be to work upward from hydrogen, in the list of heating values of the elements, and chemists have done just that. First they came to the metal beryllium, which yields about 29,000 b.t.u.'s to the pound when it burns. But beryllium was relatively scarce and difficult to refine, and so, too. So researchers for the Air Force and Navy projects passed it over. Next came boron, with 26,000 b.t.u.'s to the pound, and then lithium, with 10,000.

Ores of both were plentiful. Boron, cause of its higher heating value, was more attractive one. From there on, the scientists' task was to find ways to combine boron and hydrogen — and possibly other "alloying" elements — in safe high-energy fuel that could be manufactured at reasonable cost. That task has now been successfully turned.

It's a pleasant irony that boron, now so vitally linked to power and speed, comes from borax, which calls to mind the plodding 20-mule teams of the past and the humdrum role of scrubbing the nation's kitchens. California's blistering Mojave desert contains a large percentage of the world's borax, found generally at places where salty lakes or inland seas have evaporated.

Continuing to explore other z-p-fuel possibilities, researchers currently are mixing many a weird brew in laboratories throughout the nation.

Metallic powders — such as magnesium, aluminium and lithium — are being blended with combustible liquids, to make some of these still-experimental fuels. Others contain such unfamiliar chemicals as aluminium trimethyl, whose preparation requires exclusion of any trace of air or moisture; on contact with air, it spontaneously bursts into flames.

The earliest avenue of research involves "free radicals" — the highly unstable fragments, with names like "methyl" or "hydroxyl," of torn-apart molecules. Because of the enormous energy that some free radicals release when they recombine, they fascinate fuel researchers.

A new technique makes it possible, after generating high-temperature streams of free radicals, to trap them on surfaces chilled to extreme cold with liquid nitrogen or helium. Thus frozen, the normally short-lived particles have been kept for hours.

This raises the vision of storing free radicals on a large scale, carrying them aloft as frozen fuel, and thawing them at will for their tremendous energy release. While that may still be far in the future, free-radical research already is actively under way for the armed forces, with the National Bureau of Standards playing a key role under a tri-service contract.

LET'S BUY AN ARGUMENT!

(Continued from Page 83)

est in matters pertaining to radiation, X-rays and such like.

Maybe you agree. Maybe you don't.

Just the reverse of energy radiated through space is energy conducted through solids and, for those who prefer this field, I pass on a letter which reached me a couple of months ago from one D.L.E.

The aforesaid gentleman could be a serious person being flippant or a flippant person being serious. One can often get into trouble by mistaking one for the other.

There are few things more embarrassing than a loud guffaw which has to be withdrawn and explained; or a serious, contemplative look which has to be contrived into a guffaw.

Heat effects are well known, as far as transistors are concerned and circuits commonly have to be manipulated to offset them, by allowing a liberal rating margin, or making them self-correcting or by the insertion of heat-sensitive resistors.

D.L.E. apparently wants to achieve stability by having p-n-p and n-p-n transistors connected back to back. Quite apart from whether such a scheme would do what he expects of it, I can't imagine anybody but component salesmen being very happy about using two of everything in a set.

But, there you are. If D.L.E. wants to "take on" transistor manufacturers for their failure to release complementary pairs to support his scheme, who am I to stand in his way?

MANPOWER NO OBJECT TO ANCIENT BUILDERS

(Continued from page 19)

pace between the stones into which a rail could be driven would be immediately beheaded.

Good quality mortar was used to join several thicknesses of large stones and bricks with which the upper part of the wall is faced.

The core of the wall consists of gravel, earth and loose stones, and the top of the wall is paved with stones in such a way that a drop of water would find difficulty in penetrating.

The top of the wall was used as a roadway for transporting materials as the work progressed. It was also used for the transportation of troops during battles.

At distances of about 250 yards along the entire length of the wall, watchtowers are built. These are 13 feet above the top and project about five feet out on each side of the wall. There are 25,000 such towers along the wall, in addition to 15,000 towers detached from the wall at strategic positions along the route. The towers on the wall are provided with two openings to permit traffic in both directions.

The wall was protected with three ditches dug along the outside. That nearest the wall was filled with water if possible. Between that and the other two ditches there were entanglements for a distance of 200 yards from the wall which is the distance to which an arrow could be shot from the top of the wall.

There was nearly 300 million cubic yards of material used in the construction of the wall. It required the equivalent of the labour of about 300,000 men for 100 years to build and it has been estimated that another army of 300,000 men were required to keep it in order.

The wall served its purpose for hundreds of years, for it enabled the people to live with security and till their crops without being molested.

However, against the organised might of the armies of Genghis Khan, the wall was unavailing, and it finally fell into a state of disrepair.

What remains of the wall is a monument of the greatest project ever attempted by man and proof that no defence is ever eternal.

PRACTICAL HOME-STUDY COURSE IN RADIO

STOTT'S Course meets the exact needs of Amateurs, Radio Salesmen, Experimenters, Dealers, Service Men, Builders of Sets, and others. This Popular Course has been designed and prepared by Experts. A Student wrote:—

"I am taking this earliest opportunity of thanking you for your splendid Radio Course. It has proved invaluable to me in my work."

Write today, without obligation, for particulars of the STOTT Course in RADIO FOR AMATEURS.

Stott's Correspondence College

100 Russell St., Melbourne; 149 Castlereagh St., Sydney; 290 Adelaide St., Brisbane; 21 Grenfell St., Adelaide; 254 Murray St., Perth

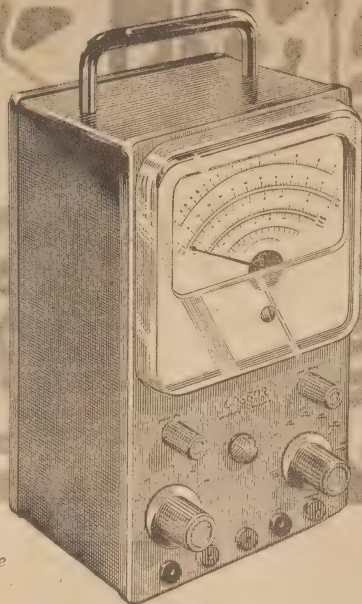
CUT HERE AND POST
TO STOTT'S: Please send me, free and without obligation, full particulars of your Course in Radio.

My Name

Address

R.H.258 Age

performance assurance with **COSSOR** printed circuits



MODEL 1044K KIT VALVE VOLTMETER

List Price
£29/-/-

A new Valve Voltmeter of equal value to the professional engineer or amateur alike is now available in Kit form.

Low in cost and providing, in addition to the several DC, r.m.s. and peak-to-peak AC voltmeter ranges, the facility for measuring resistance values over wide limits, this compact instrument deserves well the popularity it has already achieved.

The use of printed-circuit techniques has made possible

the inclusion of a circuit board which, whilst forming the nucleus of the assembly prevents, automatically, any error in the layout of components and thus assures the attainment of the design specification.

The assembly of the instrument requires no skill other than that needed to use a soldering iron and each step in the construction is covered clearly in the well illustrated Manual.

AVAILABLE **NOW** FROM SOLE AUSTRALIAN AGENTS
AND DISTRIBUTORS IN ALL STATES



JACOBY, MITCHELL & CO. PTY. LTD.

477-481 KENT ST., SYDNEY

Phone MA8411

LETTERS TO THE EDITORS

A. J. (Melbourne, Vic.) sends in an account of an experience with a communications circuit which he has been at loss to find. It appears that on switching the circuit a trial run the ABC Television service through quite clearly at several points on -6 Mc. band. However, after the circuit was set up, no amount of coaxing would produce a sound.

The experience you describe may have been caused by a temporary fault in the transmission line. It appears that the signal which was the circuits of your receiver. The fact the sound carrier is Frequency Modulated does not prevent a reasonable degree of intelligibility from being obtained from an AM detector when tuned to the slope of the signal curve.

F. R. (Ethelton S.A.) has extracted some from an overseas magazine, concerning control of modulator and asks us to supply missing component values etc.

We regret we cannot undertake jobs of this kind. F. R., which are virtually complete jobs. In any case such equipment would not certainly not conform to local requirements and we suggest you should contact the Department for the Control of Imports, which is under the radio control equipment may be imported in this country.

P. (Madang New Guinea) forwards us details of a radio stage used in an advertisement radiogram, together with his own pushover of the same idea.

Many thanks for your letter J. P. and friends you enclosed. There have been many attempts to eliminate the output transformer to achieve the various advantages you state, and most of them are based on the use of a low impedance output valve, usually 6X4, and the development of special speakers of higher than normal voice coil impedances. So, the final result is often very much more complicated than it seems, that matching is comparable with that of a transformer being obtained. As a result, there is a very chance that the distortion introduced by mismatching or lack of power reserve will be due to the presence of a transformer.

At this stage we have not the time to analyse the circuit in detail though we may do so and comment is therefore difficult to comment. However, regarding your own circuit we feel that the use of a transformer large enough to give a power reserve will be a fallacy to assume that the quality of the transformer is of no importance, simply because it happens to operate at relatively low impedance. It is true that such a transformer is little easier to make while retaining good characteristics, but this is very different from assuming any of the transformer is automatically a fidelity unit, simply because it operates at low impedances.

T. R. (Ballarat Vic.) has built the crystal transfer set described in the April, 1957, issue, but complains that results are poor.

We agree J. T. R. that you should be getting better results than you describe, though it is difficult for us to diagnose the trouble at a distance. The best approach would be to set the set in two sections; the front half containing the crystal and the transfer transformer as an amplifier. Even with the crystal alone it should be possible to get some of results, particularly at the shorter distances. If not, this circuit should be checked and adjusted until it is working correctly, and connected to the amplifier. Conversely, if crystal set works properly, the amplifier section should be checked.

R. (Carlton N.S.W.) built a shortwave converter described in "Wireless Weekly" in 1936, and had good results on wavelengths as short as 16 meters. However, he would now like to see a converter described capable of working down to 10 meters.

Valves have improved a great deal since the converter you have built was described and would not be too hard to give very good performance on 10 meters by comparison. The wave converter described in the October issue, for example, would work quite well on 10, 11 and 13 meters given suitable coils. The modifications required would be mainly to reduce the number of turns on the tuned winding of the aerial and oscillator coils. If you would like to build a more elaborate converter, we have been a number of circuits published in the past. The amateur band converter described in the January issue is an example. If the three gang tuning capacitor were connected across the entire coils instead of the spread taps, a wide tuning range would be obtained.

C. (Landsborough, Qld.) has some colour coils which he would like our assistance in tuning. The standard R.M.A. colour code for IF transformers is: blue-blue lead, red-B plus, green-(or diode) and white-red (or diode) return, last is the connection often marked "AVC". If your coils use this coding is another matter.

I. G. (Upper Orara, N.S.W.) is another of those readers who would like to build a converter to tune into and catch satellite signals. He suggests that builders of such converters could buy frequency measuring equipment.

A. Glad to note your interest T. G. but it isn't as easy as all that. The old story of the radio wagging the horse may have some application here. Frequency measuring equipment capable of locating the signals with certainty is expensive and may not always be available. In any case, there is nothing to listen to at the time of writing.

B.L. (Moonee Ponds, Vic.) writes to express his appreciation of the magazine and to ask if we can supply a simple circuit for a TV set, comparable with a crystal or one valve set in the radio field. Alternatively, he would like a "sound only" section for a TV set.

A. We wish it was as easy as that B. L., but the truth is there is no counterpart to these simple radio sets in the TV field. There are some very separate functions which must be performed that it is impossible to simplify TV set design to any appreciable extent. Your best bet would be to make the sound section for a short, we strongly advise that this is a standard portion of a full scale receiver, such as our 17in model. In addition to the power supply you will require the IF strip, the audio section, and a tuner. The latter may be purchased ready made, if you prefer. If all this is assembled on a standard TV chassis and the sound section completed satisfactorily, the picture portions of the set may be added later as time and finances permit. Tackled this way, the project is not nearly so frightening as if it is taken in "one bite".

M.C. (Frankston, Vic.) wishes to know if a type 7193 valve will replace a 615 or a 6V6 in the 288 Mc receiver featured in our February 1956 issue.

A. The 7193 valve is a triode valve similar in characteristics to the 615, the difference being mainly physical, in that the grid of the 7193 is brought to the top of the valve. It should therefore be a suitable replacement for the 615 but, for obvious reasons, it will not replace the 6V6.

P.R.S. (Concord, N.S.W.) wishes to know if it is possible to obtain copies of the issue dealing with crossover networks through our query service.

A. We regret that the issues containing constructional details on crossover networks are no longer available. However, through our query service we are able to supply reprint of the circuits etc., which contain an appreciable amount of text. A panel setting out the fee and conditions for query service is featured on this page.

P.T.M. (Byde, N.S.W.) seeks an explanation on some terms dealing with crossover points, etc., which he has seen in the magazine.

A. We feel that your queries may be more appropriately answered in the Here's Your Answer Tom feature and we are filing your letter for possible inclusion in this feature at the earliest opportunity.

L.H. (Taree, N.S.W.) raises a query regarding a multimeter he has constructed and, in which apparently, he has used an 11 position switch with the moving arm wired both as a 12th contact and as the moving arm. For obvious reasons the results were disastrous on the 12th position which is the ohms x 1000 position.

A. The circuit to which you refer calls for 12 position switch. We suggest that you obtain such a switch or at least the wafers, since the existing clicking plate and shaft may be retained. The construction of the wafer on a 12 position switch differs from the usual 11 position switch and may be readily recognised.

A close inspection will reveal a moving arm and wiper, as well as a contact on the underside of the wafer. This contact is for the 12th position there being room for only 11 positions and the moving arm on the upper side of the wafer.

Moving in a clockwise direction from the moving arm contact, the positions are used in the normal manner. After the 11th position, the moving arm contact is reached and the top section of the wafer ceases to function. However, as the switch is clicked into this position, the moving arm on the underside of the wafer connects with the 12th contact which is placed directly below the first contact but insulated from it. Since the two moving arms are interconnected the action of the switch doubling back on the moving arm only disconnects the top section of the wafer while the underside section comes into use.

H.W.P. (Roma, Qld.) sends in a project for the Reader Built It feature and has some appreciative comments regarding our journal. H.W.P. also wishes to know whether we intend publishing the indexes, which we have omitted, for volumes 16 and 18.

A. We thank you for your comments and the project which we shall file for possible future use on the appropriate page. We are having difficulty in finding space for the publication of indexes; however, we intend to do so at the earliest opportunity.

H.E.S. (Faulkland Islands, Sth. America) intends to settle in the Blue Mountains district on his arrival in Australia, and wishes to know the kind of reception that could be expected in places like Leura and Blackheath. H.E.S. goes on to express his appreciation of our journal.

A. We thank you for your comments about our journal and trust that you will continue to enjoy it on your arrival. Most of the Blue Mountains area offers excellent prospects for good TV reception except, of course, in the obviously shielded areas. Positions in gullies and with large land masses to act as obstructions may introduce difficulties in the form of reflections and weak signals.

The Radio, Television and Hobbies Query Service

All queries concerning our designs, to which a POSTAL REPLY is required must be accompanied by a postal note or stamps to the value of TWO SHILLINGS.

For the same fee, we will give advice by mail on radio matters, provided the information can be drawn from general knowledge. UNDER NO CIRCUMSTANCES, however, can we undertake to answer problems involving special research, modification to commercial equipment or the preparation of special circuits.

Whatever the subject matter, we must work on the principle, that a letter is too involved if the reply takes more than 10 minutes of our time.

Queries not accompanied by the necessary fee will be answered FREE in the columns of the magazine and presented in such a way as to be of interest to other readers.

To those requiring only circuit reprints, &c., we will supply for TWO SHILLINGS diagrams and parts lists from our files covering up to three constructional projects. Scale blueprints showing the position of all holes and cut-outs in standard chassis can be supplied for 5/-. These are available for nearly all our designs but please note they do NOT show wiring details.

Address your letters to The Technical Editor, RADIO, TELEVISION and HOBBIES, Box 2728C, GPO, Sydney.

Note that we do not deal in radio components. Price quotations and details of merchandise must be obtained direct from our advertisers.

Transcription quality manual players

With every feature to satisfy
the most critical listener

ELAC MIRAPHON



Special spring mounts, Rubber matted balanced turntable, constant speed motor, no WOW or RUMBLE. In attractive burgundy enamel and white trim.

No. 10, with New Wide Range Crystal Cartridge response 30-15,000cps

£21/10/-

No. 11, with Variable Reluctance Turnover Cartridge response within 2db 20-19,000cps.

£42/10/-

LOUDSPEAKERS

Goodmans Trebax Tweeter	£11.19 3
Goodmans XO/5,000 Crossover	£4 6 3
Goodmans Midax Unit	£24 5 0
Goodmans XO 750/5,000 Crossover	£14 2 6
Goodmans AxleHe 101 8in.	£15 1 0
Goodmans Axiom 150 Mk. II	£28 7 6
3-Speaker System by Wharfedale.	
Wharfedale Super 3in. (Treble).	
Wharfedale Super 8FS (Middle).	
Wharfedale WIS/FS (Bass): Total	£70 16 1
Wharfedale 8FS/AL	£13 12 4
Wharfedale Bronze 10in	£11 0 0
Wharfedale Super 12/FS/AL	£44 3 7
Wharfedale WIS/FS	£44 3 7
Rola HI FI 12U.X. (Twin Cone)	£28 19 5
Peerless Coaxial 12in, 5in.	£16 17 6
Barker Duode, 10in	£37 7 6
Peerless 5in Tweeter	£3 16 0
Ibbot 360 Tweeter	£14 14 0
Magnavox Twin Cone	£7 9 7
Lorenz Electrostatic Tweeter, LSH75	£0 16 6
Lorenz Electrostatic Tweeter LSH100	£1 7 6

AMPLIFIERS

Gramphon Mullard MAS-10B and T.C.	£51 9 0
Armstrong A10 MkII and T.C. 10w-12w.	
Peak. Excellent value at	£84 10 0
Leak TL/10 and T.C.	£74 11 0
Stereophon 10w and T.C. wide band tuner	£68 5 0

TERMS ARRANGED

PICK-UPS, PLAYERS TURNABLES

Leak dynamic P.U. L.P. diamond head.	£23
M.B.H. Pick-up, 12in. L.P. head	£14
Golding LSA Pick-up arm	£7
Ronette 16, 12in Turnover Pick-ups	£7
Collaro Transcription Pick-up, 16in	£4
Collaro Transcription 2010 Turntable	£26
Connoisseur Transcription Turntable	£49

HI-FI ACCESSORIES

Collaro Transcription Sapphire	£1
Collaro Transcription Diamond	£7
Garrard Stylus Pressure Gauge	£1
Cook N.A. Beam distortion test record as described in August R. and H.	£2
Serlon Frequency Test Record	£2
Serlon Woven Plastic Grill Cloth. Brown with woven pattern, 27in wide, per yard	£1

CABINETS

Sherwood Goodmans A.R.U. Cabinets, Maple or Walnut with A.R.U.	£34
Sherwood less A.R.U.	£28
Wharfedale Sandfilled Corner Speaker Panel for 15in. and 12in. Speakers.	
Maple	£28
Wharfedale Treble Cabinet for 8in. and 3in. to complete 3-speaker system with above	£15
HI-FI Equipment Cabinet 2-door Maple	£20

NEW PRICE LIST

Send 2-3/4 stamps to cover cost of our new Descriptive Price List chock full of HI FI information that will assist your buying now or planning for the future.

Demonstration Centres:

35 Lewis St., Balgowlah and 121 Forest Rd., Arncliffe

City Office only: 126 Buckingham St., Sydney.
Telephone XJ4193

amplasound co.

• a c o s • CRYSTAL STICK MICROPHONE (Type Mic 39)



Illustration shows microphone on desk stand

PRICE, £8/19/6

Available from leading radio houses

A new and beautifully styled microphone for use as a hand, desk or floor unit.

A special liner in the case eliminates hand-capacity effects. Special screening gives greatly increased signal to noise ratio and FEED BACK IS REDUCED TO A MINIMUM. Designed especially for high-quality recording, public address, dance bands and broadcasting work.

- Frequency response flat 50 c.p.s. to 10 K.c.s.
- Omni-directional.
- Overall length, 4½ inches.
- Maximum diameter, 1½ inches.
- Minimum diameter, ¾ inch.
- Supplied with 8 ft. special noise-free screened cable.

AMPLION (A/sia) PTY. LTD.

101 PYRMONT BRIDGE ROAD,
CAMPERDOWN, SYDNEY, N.S.W.

(Melbourne, Vic.) asks whether it would be to use a portable or a mantle set as a tracer and whether the RF portion of these could be used as a signal generator RF portion of the defective set. He also asks to know whether all valves show a visible glow when operating.

It is possible to use a receiver as a signal and, in fact, most signal tracers bear some resemblance to a receiver. However, these devices are either untuned in order to cover all the frequencies likely to be encountered, or capable of being tuned over a wide range of frequencies. An ordinary set, of course, would not provide the requirements. We think that you are a little track regarding the RF portion of a set used as a generator. Not in any circumstances could it be regarded as such. The filament of all valves give off some light when they are operating but may not always be visible. The glow off by battery valves is quite low and the filament is well hidden by the reflector elements so that it would be necessary to use the valve in very dim light to see any glow.

T. (Windsor, N.S.W.) wishes to add an answer to a 5-valve portable set and would like comments and, if possible, a circuit.

We are unable to provide a circuit for a set nor do we think it feasible to add an RF stage to an existing one. Even if this were done we doubt whether the improvement would be noticeable. Increasing the range is simply a matter of increasing the sensitivity assuming that this could be done. Sensitivity, because no amount of increased sensitivity will make a signal audible if it is masked by atmospheric noise. Thus there is a limit to the degree of sensitivity beyond which it is normally little to be gained. In practice, the order of gain should be obtainable with a set of set you have on hand. The only improvement possible in difficult situations is the use of an efficient aerial. If you find that under some conditions other sets give consistently better results, we suggest that your set is not working and it would be advisable to try a different set.

C. (Mandurah, N.S.W.) writes in to express his appreciation of the magazine and to make some suggestions on future problems. B.P.C. wishes to know whether a 12-inch cathode ray tube VCR131 is suitable for use in our television receiver.

We note your kind remarks with much interest and we shall keep your suggestions in mind. The type VCR131 is quite suitable for our 5-inch television receiver and we suggest you refer to the November, 1957 issue of our journal for suggestions on its use and other types.

(Brisbane, Qld.) asks our advice about the best indicating the volume level in a speaker.

We feel that the most straightforward solution to your problem may be to wire a meter in with a multiplier resistor and rectifier across the speaker line. The multiplier resistor could be selected to give suitable deflections over the range of sound levels you require. The total effect would be that of a low range AC voltmeter connected across the line. Most likely you will not be able to calibrate the meter in absolute units but it is sufficient to know that a certain reading indicates a comfortable listening level.

J. (Toowoomba, Qld.) has built the 'type' receiver using a 6A7 valve in place of a 6B6 and is troubled with motorboating effects.

We think it most likely that the 6A7 is the cause of your trouble, the 6B6 being a somewhat better choice. The 6A7, on the other hand, uses a common electron stream for both sections and the coupling is probably great enough to cause feedback. We regret that we cannot suggest a cure other than the fitting of the 6B6 valve.

S. (Randwick, N.S.W.) is troubled by a hum in his amplifier and wants to know if we can tell him what it is.

From the brief information that you have given, it would be impossible for us to more guess at what the trouble might be. We only suggest that you go over the set for loose joints, tap each component to see if the noise is aggravated and, if possible, use some spare valves for a trial replacement. We think it may become necessary to enlist the aid of a serviceman.

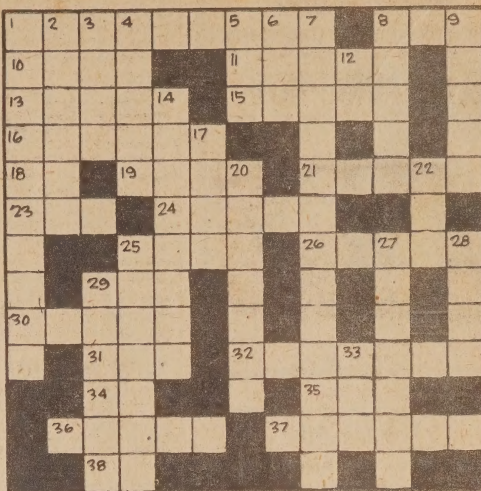
M.K. (Glebe, N.S.W.) would like to know the best way to strip the insulation from wire when using it as an aerial.

No C.M.K., the insulation makes no difference when using the wire as an aerial. Only point of contact with the lead-in need be made to make a good electrical contact, and

ACROSS

1. Instrument for measuring wavelength.
8. An unctuous liquid drawn from various substances.
10. Hinder part of the foot.
11. Any plane surface (pl.).
13. To rub out.
15. Short, highly penetrating X-rays.
16. Feeling of pain or sickness.
18. Chemical symbol for tantalum.

19. To prepare for publication.
21. To exercise.
23. Artfully cunning.
24. Form of oxygen having deodorising qualities.
25. First man.
26. Beast of burden.
29. Some.
30. Film actor.
31. Before.
32. Marked with spots.
34. Word of denial.
35. French for King.



36. Watery part of vegetables.
37. Persons who give their blood for transfusions.
38. Editor (abbrev.).

DOWN

1. Bridge used for measuring resistance.
2. Antenna.
3. The flesh of a calf.
4. Girl's name.
5. Label.

6. Historic period of time.
7. Regulated and directed from a distance (2 words).
8. Chief industrial city of Japan.
9. Unit of light energy.
12. Ante Meridiam (abbrev.).
14. Another name for autodyne.
17. Site of the Pyramid.
20. Small drum (pl.).
22. Water solidified.
25. Type of barometer.
27. Place in Cornwall from which the first transatlantic broadcast was made.
28. Noisy.
29. A walk bordered with trees.
33. A unit of weight.

Solution and further crossword next month

preferably soldered. Insulators, of course, will still be required at either end, and the lead in will have to be insulated to prevent shorting at the point of entry into the house and other points.

K.B.F. (Strathfield, N.S.W.) has a set which fades suddenly and which can be restored by switching off and on again.

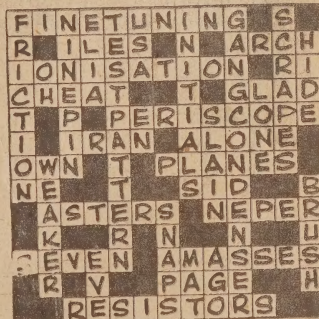
A. The fading trouble with your set is not an uncommon one although it may be very difficult to trace. It is usually caused by a defective connection which stays intact for long periods and then becomes intermittent. A frequent offender is a paper capacitor although almost any other components may cause the trouble. If other components may be the cause, we suggest that you enlist the aid of a serviceman or an advanced experimenter.

J. G. W. (McSeymour, Tas.) wants to know why he can only receive morse stations when he switches his four valve receiver to the short waves.

A. It is most unusual not to hear at least one or two program channels. It may be that your receiver is only covering a limited band between those normally occupied by the program transmitters. Alternatively, your receiver may be very insensitive and only picking up a few strong morse stations. In this case, a larger aerial might help. If you cannot find the trouble yourself, it may be necessary to seek a spot of local advice, from someone who can examine the receiver.

B.W. (Hamilton Vic.) has been experimenting with insector and has picked up several overseas short-wave transmitters.

A. Many thanks for your report B.W., and the

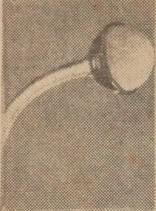


Last month's solution

results are certainly interesting. However, we feel that the effect is a random one, and indicates that very much better results should be possible if a correctly designed tuned circuit was used. We suggest it would be worth while experimenting along these lines.

AWA
RONETTE

MICROPHONES & ACCESSORIES



Type 088/F
£9/5/11

Complete with flexible arm.

Technical pamphlets will be mailed on request. Other types also available

from
CHANDLERS PTY. LTD.
ALBERT AND CHARLOTTE STS.,
BRISBANE

VALVES

Mostly all types can be purchased at

KEEPS

14 Oxford St., Sydney.
Phone FA1100.

Printed and published by Supravure Ltd., at the registered office: 21-29 Morley Avenue, Rosebery, N.S.W.

ROYCE DISC RECORDING EQUIPMENT

HI-FI CUTTING HEADS, HOT STYLI, AMPLIFIERS

Labels, Stroboscopes, Turntables, Blanks and All Accessories for the Recordist. Write for Catalogue of Prices.

BOX 5041Y, G.P.O., MELBOURNE

VIC., ROYCE RECORDING SUPPLIES, 291 EXHIBITION ST., MELB.

FB2592. S.A. SCOTT SALES, 99 CURRIE ST., ADELAIDE, LA1201. ML4919



VACUUM MOUNTED CRYSTALS

for general communication frequencies in the range 3-14MC. Higher frequencies can be supplied.

THE FOLLOWING FISHING CRAFT FREQUENCIES ARE AVAILABLE IN F.T. 243 HOLDERS

6280, 4095, 4535, 2760, 2524

AMATEUR TYPE CRYSTALS 3.5 AND 7 MC BAND

Commercial—from £3/12/6 each, plus 12½% Sales Tax.

Amateur—from £3/- each, plus 12½% Sales Tax.

Regrinds £1/10/.

Crystals for Taxi and Bush Fire Sets also Available

We would be happy to advise and quote you as to the most suitable crystal for your particular application either in the pressure or vacuum type holder.

New Zealand Representatives:—Messrs. Carrel & Carrel, Box 2102, Auckland

BRIGHT STAR RADIO

46 Eastgate St., Oakleigh, S.E. 12; Vic. UM3387.



WANTED TO BUY, SELL OR EXCHANGE

FOR SALE: Back Nos R and H for sale. April, 1939, to Oct., 1956, 2/ posted. Nov., 1956 to current copies 4/ posted, quote on large lots, also will buy spare R. and H. you have. If out of stock, I will get it for you. A. J. Cox, 13 Glover St., Belmont, N.S.W.

FOR SALE: Tape Recorder, Emicoorder 2301 7 1/2 in. per sec. Hi-Fi excellent condition. Complete with mic. Manual, 12,000 ft. little used tape. Your offer considered. Private sale UL2717 after 7 p.m. No Sunday.

SALE: Castings and designs for all engineering students. Castings to own patterns. Bolton, 72 King St., Sydney. Catalogue 5/-.

FOR SALE: Microphone R.C.A. type, 77B, 200 or 50 ohms imped. Best offer accepted. UM8481.

FOR SALE: Playmaster No. 13 amp, 12 wr and HF5 Magnavox speakers. Philips AG 2002 player with AG3012, AG3013, AG3025 plug-in heads. Twin Jensen with cross over SE 5000 x 12.5 ohms. P. A. Trans. Phone YB3447, after hours.

WORK AVAILABLE: We want someone, preferably part-time and in his own workshop to make simple stop switches for electronic organs. This can well become a profitable and unique business in the Southern Hemisphere. Maker should be handy with simple metal work, and preferably live in Sydney area. Electronic Organ Co., 11 Cadow Street, Fyvie, N.S.W. Please apply in writing.

FOR SALE: SBPI's £3 each, 1 doz. available. 86 Campbell Hill Rd., Chester Hill, Sydney.

SELL: Goodman's Axiote in polished vented enclosure, £16. Jensen four speaker system, £12. Goldring PU 555 cartridge, £9. WL1912, 10 Hamilton St., East Kew, Vic.

SELL: ARB Communications Receiver, 4-band 240v £22½. 2 Ian Ave., Nth. Curl Curl.

SELL: A.R.C. Multimeter, Sign Tracer Oscillator, AF Amplifier, fully auto calibrated, AC or Battery, incl. case, n and RF probe, £50. Paton VIM, 600 £40. Bargain 61 x 121 tent for days, £15. HD 42WLA and Outfit, cond., £100 or nearest offer.—I. JAN Briggs Crescent, Noble Park, Vic.

SELL: Wharfedale 12in/CS/SL Speaker. Connoisseur Transcription Turntable, £30. Leak Pickup with 2 diamond Transformer £19. Chapman 360S tuner spread. Cost £93. Take £40—J. A. Morgo Street, Urunga, N.S.W.

TELEVISION and Radio Practical
Class. Learn in a friendly way. Mondays, 7 p.m. Evening College, Bondary Public School, Wellington St., Bondary formation, MX1694.

SELL: Tape deck £10, 2 speeds. Has cast brass flywheel, record playback (wired motor rewound, motor three pos. Needs tape pressure pads. Phone (Sydney).

SELL: We have several sets of 12, complete with cocktail for 12AX7 for home constructor of Minsha El Organ. £4/10/- per set of 12. You not make them for this price. El Organ Company, 11 Cadow Street, N.S.W.

BOOKS: A new series of advanced electronic works, as well as popular radio books. See our advertisement elsewhere in issue. Electronics Publications (Aust.)

WANTED DONE: We want chokes for audio projects. This work will be individual or firm to have audio coil windings machinery, and will include ion clamps. Please apply to us in Box 5557, Radio and Hobbies, C/o Sydney Herald, 26 Hunter St., Sydney.

SELL: Leak TL/12 and variolone w cover, £70 F.O.R. Connoisseur in 2-speed, £18, perfect condition. Stew Lewin St., Bardon, Brisbane.

FOR SALE: Philips T.V. test equipment, generator, marker, generator and oscilloscope. As new, £300 or sell sep. Velco Sound Systems Pty. Ltd., 520 Bridge Richmond, Vic. JB2511.

SELL: SCR 522 incom, £2, 1812/7 CR shield, £2.2. F. Phones, £3, 1 Darl Randwick.

SELL: ATATIC DK1 crystal microphone £20 to land, sell for £10, brand n Jones, 25 Panoramic Rd., N. Balwyn, Vic.

SELL: All back issues R. TV & H, £2/- per copy incl. post or 2 for 3/ copies 3/- ea. T. Weir, 56 O'Connor St., eld. UA2569.

BUYING TEST EQUIPMENT

PATON, UNIVERSITY, AWA, etc.

Easy terms available

Trade in your old instrument

Write, call or phone for details of the instrument which interests you. Literature sent on request. city—country—interstate.

THYRON RADIO SUPPLIES

WX3428.

233 Victoria Rd., Gladsville, N.S.W.

See address elsewhere in this issue

T.V. ALIGNMENT AND CHECK UP SERVICE.

Available on the most modern lab. equipment. Pick-up and delivery service available. St. George-Sth. Sydney and adjacent area. Open Saturdays. Closed Wed. afternoon.

165 GENERAL HOLMES DRIVE.

BRIGHTON LE SANDS

Nr. Cook's River Bridge.

BE YOUR OWN BOSS

Make £10, £15 or £20 a week at home in your spare time. Get details of my Guaranteed Money Making Plans. Special courses of instruction FREE. Don't miss this opportunity for extra cash. Write NOW Desk R.H. PROFFIT ENTERPRISE (reg.), Box 5070, G.P.O., Sydney.